MEDICAL & SURGICAL SCIENCE

ITS CONCEPTION & PROGRESS

S. HILLIER, M.D.

XXth CENTURY SCIENCE SERIES

To Dr L'Edwart from [illegible] Lee
Chairman
Booth Hall 9

New Year 1926

In the hope that it may encourage him, in his many difficulties, to keep his Ideals ever before him.

DOX.

(Dedicated to the many doctors who have shown me kindness.)

Of all the men about you see there's none so good as doctors be; the lucky never ring their bell, yet happy him who knows them well. There's good and bad, for men are mixed; but everywhere you'll find it fixed that while they are the last to boast, the Dox are better men than most.

Compare 'em to that pizen gang the lawyers, wi' their greedy fang, and quick you mark the difference 'tween honesty and mere pretence; though lawyers say they're honest men, their neighbours murmur "Liar" then; but Dox—'tis everywhere agreed—are granite in the hour of need.

These Dox are patient men and kind, they listen hard and never mind whilst you explain how curried lamb has festered in your diaphragm: they rise from bed at midnight hours and face the winter's icy showers to hear you whisper—by degrees—you've been a pig on toasted cheese.

We long to see 'em when we're ill, yet hardly ever pay their bill 'coz of their suicidal way of never forcing folk to pay; an' that's the reason when they die from slaving all the hours that fly, instead of resting now and then, they're found to be the poorest men.

You never saw a lawyer make in all his life that strange mistake (widders and orphans full of trouble the lawyer mostly charges double). But doctors' hearts are much too large, they often work without a charge, and when they rest beneath the mould their tombstones should be made of gold.

Bernard Gilbert.

By: Mr. John M'Ewart.

Medical & Surgical Science

LORD LISTER.

(*Photo. by* ELLIOTT & FRY.)

Plate I.] [*Medical Science, frontis.*

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BY

S. HILLIER, M.D.

AUTHOR OF "POPULAR DRUGS: THEIR USE AND ABUSE," ETC.

Illustrated

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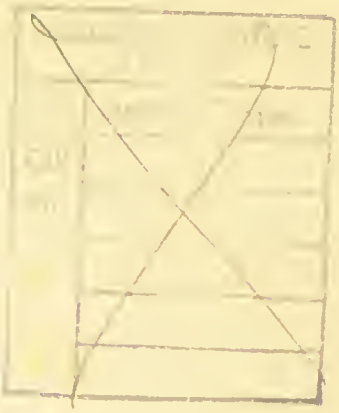

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The Publishers are indebted to MESSRS. ELLIOTT AND FRY *for their permission to use the portrait of Lord Lister; to* THE ROYAL COLLEGE OF SURGEONS, LONDON, *and* TRINITY COLLEGE, CAMBRIDGE, *for permission to reproduce engravings from scarce works in their Libraries; and to* THE LONDON HOSPITAL *for the illustration of the Finsen Light in use.*

Medical Science.

CHAPTER I.

EGYPTIAN MEDICINE—HINDU AND CHINESE MEDICINE—EARLY GREEK MEDICINE—ÆSCULAPIUS—HIPPOCRATES—THE DOGMATIC SCHOOL—ARISTOTLE—THE ALEXANDRIAN SCHOOL—HEROPHILUS—ERASISTRATUS—THE EMPIRICS.

FAR back in the very earliest historic times, the virtues of the healing art are set forth in literature. The principles enunciated, based as they are on myth and fable, and flourishing in an atmosphere of superstition and ignorance, are of little value or interest except from an historic or antiquarian point of view.

Egyptian civilisation furnishes us with the first literature on medical subjects. There are about a score of Egyptian medical papyri extant, some of them claiming to date back as far as B.C. 4000. By far the largest and most important is one consisting of about 107 pages, which is dated B.C. 1500. It was found in a tomb at El Assassif, in ancient Thebes, and is in the possession of the Leipsic Museum. Although our admiration and wonder have often been aroused at the knowledge of the exact sciences, and skill displayed in their application, by the ancient Egyptian engineers in accomplishing the stupendous task of building the

pyramids, we cannot in the same degree compliment the ancient Egyptian medicine man on the extent or accuracy of his knowledge as set forth in this papyrus. The preface runs somewhat as follows:—

> "Beginning of the book of preparing remedies for all parts of the body. I come from Anu with the priests of Hetuat, of the Lord of healing, the king of eternity, and protector. I come from Sais with the mother Goddess who guards me. There is given from the Lord of All the word to remove all deadly disease of all sorts. There are sections for the head, neck, arms, flesh, limbs, to remove the hurt done by the Ruler of those who have brought diseases on my flesh. It is his guide Tehieti who gave me this word. Whom the God loves he makes to live—I am one whom the God loves: He makes me live."

The treatise mainly consists of a number of prescriptions for various diseases. In addition there are numerous diagnostic aphorisms, mostly about abdominal diseases and swellings, and there are also numerous magical spells set forth. Some of the prescriptions, of which only two or three can be selected, are of interest because of their exceedingly quaint and peculiar character. One, a purgative, consists of equal parts of:—

Uam Seeds,
Aneb Herb,
Keseb't Fruit,
Honey and S'neft.

We have no means of ascertaining what these substances are, and cannot, therefore, estimate their value. Where the ingredients can be identified, we are not impressed with their power, and from the disgusting nature of some, we fear they were likely to have been "honoured in the breach rather than the observance."

One prescription, composed by King Teta as a hair-oil for his mother, Ses, will not, we fear, arouse any enthusiasm amongst modern sufferers from baldness. The ingredients were: Asses' hoofs, dogs' claws, and dates, all boiled and rubbed up together in oil.

For blindness, two pig's eyes and the fluid belonging to them, eye powder, vermilion and honey equal parts, rub together and put into the patient's ear, repeating this formula twice: "I have brought this thing and put it in its place; the crocodile is weak and powerless."

As an example of the aphorisms the following may be quoted:—

> "If ye see one with a swelling feeling like dough, his body is hard under it, he is sick in his ro-ab. It is a swelling of his body that finds no way out, and there is no passage for it out: it is corruption in his body. Nothing comes out. It is the hesept worm. If it be not the worm, it feels like a ball. If it empties he gets well; purge him and immediately he will get well."

Ro means mouth and *ab* heart, so that "ro-ab" should signify "mouth of the heart," but the symptoms described above certainly suggest abdominal trouble of an obstructive nature. The vague and indefinite character of the symptoms described clearly demonstrate an entire lack of any definite knowledge of abdominal diseases. Apparently they were all classed under one head, and those which failed to respond to purgative treatment inevitably proved fatal. Abdominal surgery was quite an unknown quantity, and being restricted in their therapeutics to the one stock remedy, mortality in these cases must have been exceedingly high.

The prescriptions are attributed to various sources, but it is interesting to observe that many of them are "gifts from the Gods."

On pages 99 and 100 of the papyrus there is an anatomical dissertation on blood-vessels. It is stated four vessels go from the heart to the nose, of which two carry slime; four divide at the back of the neck to nourish the hair; four go to the two ears, the breath of life goes to the right ear, the breath of death to the left. Six vessels go to the two arms, six to the legs, two to both testes, four to the liver bringing moisture and vapour, four go to the intestine, and two to the bladder. As Dr. Macalister truly says:—*

"Egyptian medicine at the beginning of the

* *British Medical Journal*—Dec. 22nd, 1894.

new empire was little else than folk-lore, empiricism, priestly tradition and magic, with no underlying knowledge of the structure of the body and no unifying theory of disease, except the elementary notion of malign influences."

The later Egyptian papyri show no advance on the above for the next thousand years, when we find the history of ancient Greek medicine beginning to unfold itself.

The Hindus appear to have had, at a very early period, considerable knowledge of the rudimentary principles of medicine and surgery. Charaka and Susruta are the two Hindu writers to whom we are indebted for information as to the scope of the healing art in their time.

It is uncertain whether the Greeks derived their knowledge from the Hindus through the medium of the Egyptian priesthood, or whether the Hindus acquired their skill and knowledge through contact with western civilisation, resulting from the conquests of Alexander. In favour of the former hypothesis there is strong evidence to show that the Orientals had themselves arrived at a comparatively high state of medical and surgical skill before contact with the Grecian influences. Their comprehensive pharmacopœia contains mercury, arsenic and zinc, and many other drugs of permanent value. Upwards of one hundred surgical instruments are described as being used by them—scalpels, scarifiers, saws, bone nippers, scissors, trocars, needles, blunt

hooks, probes, directors, sounds and forceps, also catheters, a rectal speculum, and bougies.

We are told tumours were excised, dropsies tapped, the abdomen was opened for the purpose of relieving intestinal obstruction, lithotomy (operation for stone in the bladder) was performed, and cataracts were removed from the eye. Inflammations were treated by dietary, venesection, leeches, cupping, and purgation. Poultices and fomentations were also used. Owing, however, to inefficient anatomical knowledge, ignorance of physiology and pathology, no advances were possible, and their principles of practice remained stationary for many centuries.

The Chinese have only to be mentioned to be dismissed—their accomplishments being far behind those of the Hindus. Their surgery was very crude and of a barbarous nature; their knowledge of medicine equally rudimentary.

As in the case of Egypt, so in the case of Greece, to the immortals is first ascribed the practice of medicine and surgery. We are told the Gods walked the earth and mingled with the baser crowd, sharing with them their joys and sorrows. Violence and disease stalked rampant through the land, and called for the utmost skill of those learned in the treatment of wounds and fevers. The Gods, though immortal, did not scorn to utilise the resources they found at hand. We are told that Pæon, skilled in the knowledge of the dressings which could ease the pain and arrest the bleeding of wounds, practised

on Mount Olympus amongst the Gods themselves. Still more did the puny mortals require the ministrations of the Deity who could ease the sufferer and prolong life. The Gods have always figured as the patrons and friends of humanity, superintending and controlling mundane affairs at their pleasure, and it was only to be expected they would themselves administer what remedies they were familiar with to succour the suffering. Thus we find in ancient legends that Orestes appealed to Apollo as tutelary God of medicine. And the wounded Æneas is cured by Venus herself, who prepares an infusion from herbs which she gathers with her own hands. We are told that Chiron imparts his knowledge of medicine and surgery to some of the heroes of Homeric fame, one of whom, Æsculapius, becomes so skilled he even raises from the dead.

This mythical character, Æsculapius, the son of Apollo and the nymph Coronis, educated by the learned centaur Chiron, was so accomplished in the healing art and so skilful in curing the most desperate diseases, that he earned for himself a reputation so famous as to inspire a feeling of veneration amongst his contemporaries and their descendants, and was worshipped as a God. His chief temples were at Pergamos, Smyrna, Tricea, and the Isle of Cos.

This cult attained considerable influence amongst the Greeks, and procured a large number of adherents; but there is no reason to attribute to it any special influence in the progress or development

of medical science. The methods adopted savoured rather of a religious character. The sick person was conveyed to the temple of Æsculapius, and after ablution, prayer, and sacrifice, was made to sleep on the hide of the sacrificed animal, at the feet of the statue of the God, while sacred rites were performed. It was believed that in the sleep thus induced in this atmosphere of religious sanctity, the appropriate remedy would be indicated by a dream. Dietetic and moral remedies were more often prescribed than drugs.

Records of cures were carefully preserved on the walls of the temples. Possibly this custom was the origin of the time-honoured plan of "recording cases," and it is highly probable that the physicians of the Hippocratic period thus learnt to accumulate clinical experience.

"There is nothing new under the sun," and the so-called modern miracles of "faith healing" which are ascribed to the sacred shrine at Lourdes, are the modern counterpart of the miracles of healing ascribed to the temple of Æsculapius. The minds of the modern disciples are just as obsessed with superstitious ideas, and just as receptive to the hypnotic effects of suggestion, as those of the ancients. No doubt, too, the type of disease cured by the Asclepiadæ was essentially functional in character, as is the case in the cures of the modern faith healer—showing that the human mind, in its credulity, its love of mystery and superstition, is the same to-day as it was 3,000 years ago.

There are no medical writings associated with Æsculapius in existence, and nothing to connect the worship of this God with the ordinary art of healing. This absence of medical literature, as far as the Greeks were concerned, holds good up to the time of Hippocrates, and we must therefore advance to later periods, styled "the golden age," when Hippocrates, called "The Great," was as distinguished in medicine as his contemporaries were illustrious in philosophy and art.

Hippocrates was born on the island of Cos, B.C. 460, and it is supposed generally that he died B.C. 377. Apart from his attainments as a physician Hippocrates stood out as a man of the highest character, exhibiting a lofty morality and a high conception of the status and conduct of the medical profession. This is clearly illustrated in his famous oath, which runs as follows:—

> "I swear by Apollo the physician, by Asklepios, by his daughters Hygeia and Panacea, and by all the Gods and Goddesses, that to the best of my ability and judgment I will faithfully keep this oath and obligation. The master that has instructed me I will esteem as my parents, and shall supply as occasion may require with the comforts and necessaries of life. His children I will regard as my own brothers, and, if they desire to learn, I will instruct them in the same art without any reward.
>
> "The precepts, the explanations, and whatsoever else belongs to the art I will communi-

cate to my own children and to such other pupils as have subscribed to this oath, and to no others. My patients shall be healed by me to the best of my power and judgment, in the best manner without injury and violence. Neither will I be prevailed upon by another to administer pernicious physic, nor will I be the author of such advice myself. I shall never recommend means to produce abortion, but will live and practise chastely and religiously. I will not meddle with lithotomy, leaving that to operators of that art. Whatever house I am called to attend, I will aim at making the patient's good my chief aim, avoiding all injury, corruption, and unchastity, and whatever I hear in the course of practice relating to the affairs of life that ought to remain secret, nobody shall ever know from me. May I be prosperous and honoured and esteemed by all men, as I observe the solemn oath, and may the reverse be my lot if I violate it and forswear myself."

The essential feature of Hippocratic practice was the recognition that disease was governed by natural laws, just as life itself, in the careful observation of which laws, the nature of diseases might be made manifest and the treatment of them rendered more rational. Hippocrates was not an accomplished anatomist, since, owing to religious prejudice, dissection was not practised by the Greeks. He was above all things a clinician, possessing abnormal powers of observation

and basing on them very accurate interpretations of symptoms.

In the Hippocratic method prognosis assumed a position of first importance. When it is considered how limited was the knowledge of anatomy, physiology, and pathology, it may be readily understood that the true nature of diseases was of necessity beyond the mental horizon of the practising physician, and consequently the field of diagnosis was much restricted. On the other hand, the constant attention and study of external features of disease, combined with a high power of accurate observation and judgment, led to an exceptional degree of skill in foretelling the result of an illness.

The following quotation illustrates the importance ascribed to this branch of the healing art:—

> "The best physician is the one who is able to establish a prognosis, penetrating and exposing first of all, at the bedside, the present, the past, and the future of his patients, and adding what they omit in their statements. He gains their confidence, and being convinced of his superiority of knowledge, they do not hesitate to commit themselves entirely into his hands. He can treat, also, so much better their present condition in proportion as he shall be able from it to foresee the future."

If the strength of the Hippocratic system lay in this recognition of the principle that disease

was governed by natural laws, and also by the encouragement of accurate powers of observation, it may be said that its weakness lay in its physiology and pathology, based on the humoral theory. According to this theory, the body was supposed to contain four humours—blood, phlegm, yellow bile, and black bile—a normal proportion and mixture constituting health, a departure from the normal causing disease.

In any acute disorder, it was supposed that these humours should form a *coction*, which was a thickening or elaboration necessary for their proper elimination from the system. *Coction* attained, *crisis* supervened. The critical period once reached, the morbid material formed by the coction of the humours of the body had to be expelled. This was accomplished in many instances by the natural powers of the patient, or might have to be assisted by the physician by means of diuretics or purgatives. It was thus necessary for the careful and skilful physician to watch the case with the utmost concentration, in order to intervene, and, at the right or critical period, to assist nature in consummating a cure.

This doctrine, so called "*Dogmatic*," founded on the humoral theory, was the most intelligible of all the ancient medical creeds, and was more in accord with the spirit of the age than any other. So firm a hold did it obtain that it has never ceased to influence subsequent medical research, and can be plainly recognised in the teaching of Galen,

Sydenham, Stahl, and many others, and even to-day is not fully eliminated.

Hippocrates was the first to divide diseases into acute and chronic. He wrote extensively on fractures and dislocations, wounds of the head, diseases of the eye, also several works on diseases of women. The treatises on fractures and dislocations are of a high order of merit. Trepanning for fractures of the skull was practised, whilst ruptures, piles, rectal polypi, fistulæ, were among the conditions treated. Empyema (pus in the pleural cavity) was treated by incision between the ribs, and evacuation of the pus.

The period immediately following Hippocrates is very barren of medical literature. For at least a century, until the rise of the Alexandrian school, no real advance was made. It is true that in this interval Aristotle flourished, but none of his writings are strictly medical. Without question, his work on the sciences allied to medicine, such as natural history and botany, were indirectly of service in enlarging the area of scientific research, and in cultivating the scientific spirit, but little of his work had any direct bearing on medicine or surgery.

The campaigns of Alexander necessarily led to a distribution of Grecian science and civilisation to the conquered nations, and Greek culture and intellectual activity found a home at more than one learned centre.

Pergamos was amongst the first and most

famous, but the reputation of this school was soon eclipsed by the lustre of its more brilliant rival Alexandria. The chief feature of the Alexandrian school was the study of anatomy, in knowledge of which it soon surpassed the Greek. Amongst the Greeks dissection was little if at all practised, whereas, in Alexandria, this branch of medical study was performed very thoroughly. The custom of disembowelling and embalming the bodies of the dead, which existed amongst the Egyptians, may have favoured this important advance. It is also stated that the organs were examined by opening the bodies of the living, criminals condemned to death being handed over for this purpose.

Two names are pre-eminently associated with this school, viz., Herophilus and Erasistratus.

Herophilus, born in Chalcedon about the end of the fourth century B.C., was a great anatomist, and is supposed to be the first to undertake systematic dissection of the human body. The Torcular Herophili, or common meeting place of the sinuses at the occiput, named after him, gives evidence of his influence upon the study of anatomy. He wrote extensively, and his writings covered the whole field of medical science. He showed great advances in anatomical knowledge, describing the membranes of the brain and its vessels, the choroid plexus, the ventricles of the brain, the tissues of the eye, the intestinal canal, and certain portions of the vascular system. He

also gave a more accurate description of the genitalia than any of his predecessors. He was a great admirer of Hippocrates, and a great clinician himself, paying very special attention to the pulse.

Erasistratus was also a diligent student of anatomy, and carefully described the brain, regarding it as the seat of the soul and the centre of the nerves. He gave a more accurate description of the valves of the heart than any previous writer, and he also discovered the lymph vessels, although he failed to recognise their function. His writings included an exhaustive treatise on fevers, hygiene, paralysis, therapeutics, and many other subjects. He regarded most diseases to over indulgence in food. Plethora was for him the prevailing disease, against which he practised venesection, fasting, and bandaging the extremities. In this respect he certainly showed a very intelligent appreciation of one of the most fruitful causes of disease—one which to-day is only beginning to be appreciated, and attacked by greater abstinence both in eating and drinking. The school of Erasistratus was more progressive than that of Herophilus, and prevailed up to the time of Asclepiades.

After Herophilus and Erasistratus there arose in Alexandria a sect styled the *Empirics*. They rejected anatomy, relying on the minute observation of the symptoms of diseases. They attributed the greatest importance to experience,

and their experience was acquired from three sources:—(1) Observation; (2) History of cases; (3) Reasoning from analogy. They were very successful in surgery, and in all the practical side of the profession. They criticised the humoral theory of Hippocrates, and contended that such indefinite and occult causes of disease could not furnish a proper basis for treatment. By repudiating anatomy, however, they exhibited decidedly retrograde tendencies.

On surveying the work of the Alexandrian school, it is evident great and permanent progress was made. The encouragement of anatomical study was an immense advance, since anatomy is the basis of physiology and pathology. The practice of the Hippocratic school was greatly improved upon, especially in the direction of surgery and obstetrics.

CHAPTER II.

GREEK MEDICINE IN ROME—ASCLEPIADES—THE "METHODISTS"—THE "PNEUMATICS"—"THE ECLECTICS"—CELSUS—GALEN—AGE OF FOUNDATION—TRANSITION PERIOD—ORIBASIUS—ÆTIUS—ALEXANDER OF TRALLES—PAUL OF ÆGINA—THE ARABIAN SCHOOL—RHAZES—AVICENNA—HISPANO-MOORISH SCHOOL—AVENZOAR—AVERROES—MAIMONEDES—THE SCHOOLS OF SALERNO AND MONTPELLIER—GILBERT OF ENGLAND—RAIMOND LULLI—ARNOLD DE VILLENEUVE—GUY DE CHAULIAC—END OF TRANSITION PERIOD.

IT has been stated by Pliny, that for 600 years Rome had done without physicians. It is impossible to pass this statement unchallenged, since it is incompatible with what is known of the history of the period. Rome, with all its wars and plagues, must have relied on something more than mere domestic medicine, and it is almost inconceivable that there should have been no accredited practitioners at least as skilful as those of Homeric times.

In confirmation of this, we find it stated that in the reign of Numa, the Cæsarian operation both for removal of a living child from a dead mother, and the converse, was enforced by law. It is also stated, that trepanning and operations for stone and fistula were undertaken, and these somewhat difficult cases would necessitate the existence of a class of skilled operators.

Amongst the first of the great Greek physicians

who found their way to Rome, the name of Asclepiades stands out in great prominence. He was born about 120 B.C., and flourished thirty years later. A man of great ability, of versatile attainments, he soon became one of the most illustrious figures in the Roman Empire. He had a high reputation as a rhetorician, and was a close friend of Cicero. For some reason unknown he abandoned letters and took to medicine. As was only to be expected from one with such philosophic tendencies, his theory of medicine reflected the doctrines of the Epicurean school, which prevailed at that time. The elements of the body he named atoms. These atoms were animated by perpetual motion, and it was by their constantly changing relations the vital phenomena were supposed to result.

He based his theory of treatment on endeavours to enlarge the pores of the body, so that disease could find egress, and to constrict them so that it could not enter. He repudiated all violent remedies such as vomits, purges, etc., relying more on simple hygienic remedies, especially bodily exercise. Far from being an admirer of Hippocrates, the humoral pathology excited his ridicule, and he sarcastically referred to Hippocratic therapeutics as a "meditation on death."

One of his disciples, Themison of Laodicea (B.C. 50), gave permanence to the teachings of Asclepiades, and founded the system known as *methodism*, in contradistinction to the Hippocratic school which was known as the *dogmatic*.

The methodists held the view that it was futile to study the cause of disease or even the organ affected. It was sufficient to know the common attributes of all diseases. They described three common qualities:—(1) relaxation, (2) contraction, (3) a mixed, stated partly lax and partly contracted. The signs of these conditions were looked for in the excretions. The treatment was on general principles, relaxation if the body was constricted, and contraction if it was too lax. This simple rule gave rise to the *method*, from which the school took its name. In their disdain of anatomy the methodists agreed with the empirics.

To Soranus of Ephesus, living in the second century, we are indebted for the main sources of our knowledge of the methodic school. Soranus was a brilliant physician of great reputation, and was famous not only as a medical historian, but also for an able work on diseases of women. This school was the first product of Greek medicine on Roman soil, and was prominent for several centuries.

Another school arising in the first century after Christ was the *pneumatic*, which was based on the theory that the pneuma, or universal soul, was the controlling agency of normal as well as diseased actions of the body.

Owing to the clashings and contradictions of these various schools, there arose a cult whose aim was to combine the good qualities of each system into one. They were styled the *eclectics*, and

amongst them Rufus of Ephesus and Archigenes were the most famous.

To Cornelius Celsus, a Roman partrician, who lived in the first century, we owe, thanks to his literary efforts, the most complete account of medical science in Roman times.

Although an accomplished student of medicine, it is doubtful whether Celsus ever practised. His claim to fame rests rather on his historical work than on his practical attainments, since he gave an admirable survey of the state of medical knowledge belonging to the Hippocratic and Alexandrian times.

Claudius Galen (A.D. 131-201) now appeared upon the scene. He was a man of liberal education and great talents, and it may be said of him that in his mind was stored the sum of human knowledge, in every department taught in his day. He was born at Pergamos, celebrated for its school of medicine, and there learned of the most distinguished teachers in all the sciences. Even as a young man he showed extraordinary ability, and early became a disputant with the most erudite in grammar, history, mathematics, and philosophy. He travelled a good deal, and studied at Alexandria. He was thus steeped in the lore of his time, and familiar with the various chaotic, divergent, and contradictory systems of medicine in vogue.

His task lay in producing some semblance of order out of this vortex of dogmatic systems, and he is generally credited, above all others, with

having accomplished this difficult task, and of having built up a foundation upon which the greater part of modern European medicine rests.

As Dr. Payne says:—*

> "He found the medical profession of his time split up into a number of sects, medical science confounded under a multitude of dogmatic systems, the social status and moral integrity of physicians degraded. He appears to have made it his object to reform these evils, to reconcile scientific acquirements and practical skill, to bring back the unity of medicine as it had been understood by Hippocrates, and at the same time to raise the dignity of medical practitioners."

After his student days he settled in Rome, and it is there most of his work was done. Although he denies being attached to any of the sects of his day, he appears to have been strongly imbued with the Hippocratic doctrines.

He was influenced by the philosophy of Plato and Aristotle, and like them depicted the soul as consisting of three parts—the irascible, situated in the heart; the negative, in the liver; the rational, in the brain.

He adopted the humoral pathology of Hippocrates, only he amplified it by tacking on the *pneumatic* theory of the notion of spirit pervading all parts and mingling with the humours in different

*Encyclopædia Britannica.

proportions. On this ground, he attacked the atomistic and materialistic views of the *methodists.*

He distinguished eight kinds of temperaments or imperfect mixtures compatible with life. These conditions, although not diseases themselves, predisposed to disease, the exciting cause being some external deleterious influence. He explained all symptoms and all diseases on this theory, and displayed great ingenuity in making the facts fit in with his theories.

Like Hippocrates he believed that diseases were cured by opposites.

In this, his explanation of diseased conditions, he showed no advance on his predecessors, whereas in his anatomical and physiological writings, he showed some material progress; and yet it was on his unscientific and metaphysical pathology that he acquired his great reputation, and it was this side of his teaching which retained firmest hold on posterity, rather than the more useful practical and scientific aspect of his work.

An example of what we so often observe: the fatal fascination, the intangible, the indefinite, the abstruse, seems to have for the human mind, often to the exclusion of the obvious, the true, the real, the bed-rock facts of the matter. A grasping at the shadow and a missing of the substance.

His reputation in his own day as a physician grew slowly, but after his death his doctrines acquired greater hold on the popular mind, and gradually assumed a position which was only under-

mined by the modern science of the seventeenth and eighteenth centuries. Galen wrote fifteen books on anatomy. He practised vivesection, exposing the muscles of living animals, and showing how contraction and relaxation of certain groups moved the bones. He was the first to classify them into flexors and extensors. To him we owe the division of the body into cranial, thoracic, and abdominial cavities, and a description of their respective organs and lining membranes.

He came very near discovering the circulation of the blood, distinguishing between the arteries and veins, noting that when an artery was cut the blood spurted out. Probably a little less reverence for authority and hide-bound tradition, a little more originality and imagination, would have led him to the discovery of the circulation, the lack of which knowledge retarded the whole science of medicine until the time of Harvey.

Aristotle thought all nerves originated from the heart; Galen showed they were derived from the brain and spinal cord, and distinguished between two kinds—those of sensation from the brain, those of motion from the spinal cord. He seems to have had some idea of the sympathetic nervous system, but failed to grasp its true significance. He speaks of glands, but failed to appreciate their true function, regarding them rather as store-houses for waste products than as agents for the secretion of valuable substances. It will thus be seen his notions of anatomy and physiology, though

crude and inaccurate, exhibited decided advances on right lines, especially in connection with the circulatory and nervous systems. Like Hippocrates, Galen stands out as a monumental figure in the history of medicine. Although the value of much of his work is obscured by its metaphysical, abstruse, and unscientific character, his original researches in the domain of anatomy and physiology entitle him to rank as one of the greatest of those who devoted their lives to the pursuit of the healing art.

With the death of Galen we have now finished what is sometimes styled the "Age of Foundation" by medical historians, and we commence a period known as the "Age of Transition," extending from the death of Galen, A.D. 201, to the fifteenth century, when the revival of learning commenced in Europe. The first portion of the transition period, until A.D. 640, is known as the Greek period, and extended up to the rise of the Arabian school.

At this period Rome was mistress of the world. Her empire, built up and consolidated by 700 years of bold, aggressive, and capable government, seemed firmly established. The savage hordes surrounding her borders, like wolves threatening their human prey, desirous of attack yet afraid to strike, were easily kept at bay. Rome, resting on her laurels, lay like a sybarite whose mental and bodily cravings were satiated. It was a re-actionary age, progress was at a standstill, in fact the tendency in science, literature, and art,

was retrogressive rather than progressive. Medical science was no exception; unenlightened by any remarkable discoveries, it showed deterioration rather than advance.

Whilst there were numerous smaller lights during this period, the lives and writings of four only need occupy our attention, and although little or no original work is ascribed to them, by their writings and teachings they kept alight the torch of learning which threatened to be extinguished. The first, Oribasius (326-403), born in Pergamos. His great work was a medical encyclopædia founded on extracts from Hippocrates and Galen, especially the latter. So much so that he was sometimes styled the Ape of Galen. He wrote with order, clearness, and precision. No original work was attributed to him, and his fame depended on his admirable summary of the views of others. The next conspicuous figure was that of Ætius (502-575), born in Mesopotamia. He studied at Alexandria, and was the first medical man of any standing who professed Christianity. It is stated he gave the injunction that when certain medicines were dispensed the following words were to be repeated: "May the God of Abraham, the God of Isaac, and the God of Jacob, deign to bestow on this medicament such and such virtues." His work, like that of Oribasius, was historical rather than creative.

To Alexander of Tralles (525-605), a higher rank must be assigned. He was not a blind follower of

Galen, although he professed great veneration for him. He showed some originality, but failed to accomplish any material advance. Living to a great age, when unable longer to continue active practice, he wrote twelve books all devoted to diseases which did not require the aid of surgery. He described the first reported case of excessive hunger and pain, due to intestinal worms. He practised venesection in the foot, not in the arm. In accordance with the superstitions of the age, he had faith in amulets and talismans, and strongly recommended them. In this he is not to be blamed, since he only reflected the mental environment surrounding him.

Following Alexander, we must note Paul of Ægina, living in the seventh century, who was the most eminent figure in this period. He was a skilful surgeon, and wrote a treatise on obstetrics which brought him considerable renown. His reputation survived through the middle ages, both in the Arabian schools and the west. He exhibited an original mind—treating hydrocephalus (water on the brain), tapping the chest and abdomen, extracting calculi from the bladder, and treating aneurism.

No other physician of any real initiative or originality arose prior to the period of Arabian medicine, and no other discoveries or advances occurred in medical science until the name of Rhazes appears, the first of the great Arabian physicians.

The period of Arabian medicine begins with the burning of the Alexandrian library by the followers of Mahomet (A.D. 640), and ends with the fourteenth century. The supremacy of this school during this period is accounted for by its history. Early in the seventh century Mahomet appeared upon the scene. By his magnetic personality, his skill in war and diplomacy, his religious teaching, he consolidated into one powerful nation all the smaller states which had hitherto composed Arabia.

In less than a century after his advent all Arabia, India, Syria, and Egypt, were in the hands of his followers.

Western Rome had been over-run, and her territories filched from her by the northern barbarians. Her eastern empire was surrounded and threatened by enemies.

This political decadence of Rome, and the ascendency of the followers of Mahomet, was reflected in the history of medicine. The conquerors absorbed the learning of the conquered, and it may readily be understood that the rise of Arabian medicine at this period was only in accordance with the ordinary laws of history. An offspring from Greek schools, it reflected the teaching of the masters of the Age of Foundation, and although it showed no great discovery, no wonderful advances for some considerable time, it vitalised all the learning of the past, and rendered clear a good deal of what had hitherto been obscure.

Rhazes, the most celebrated of the early Arabian physicians flourished in the ninth century. He wrote voluminously on all subjects. He is famous for having first described small-pox and measles in an accurate manner. His great work, the "Liber Contineus," was encyclopædic, and summarised the whole of medicine and surgery up to his time. Many other names of minor importance crop up during this century, but none are of first importance.

At the end of the tenth century, Avicenna appears, a prominent figure, a master of mathematics, philosophy, astronomy, and medicine. He wrote several books, the most famous of which, the "Canon Medicinæ," was a classic for six centuries. Owing to his love of metaphysics a great deal of his writing was very obscure, and it cannot be said any of his work was creative in character, or of permanent value. An offshoot of the Arabian school was the Hispano-Moorish, which in its tendencies was antagonistic to that of Avicenna. Associated with this school, we have the names of Avenzoar, Averroes and Maimonedes. Avenzoar, living in the twelvth century, was more practical and less philosophical than Avicenna. He wrote a treatise on renal diseases, in which he outlined the treatment of stone on the kidney and described an operation for it. Averroes, his friend and pupil, followed the same lines and wrote extensively. Maimonedes founded a school of philosophy in the East. A theorist rather than a physician, he was the last of the Arabians who deserve mention.

The Arabians reflected Greek medicine, but in most respects, especially in anatomy and physiology, were behind them. They were the first to describe eruptive fevers, and showed some advance in the knowledge of purgatives. Their skill in chemistry enabled them to prepare new drugs, and they produced the first pharmacopœia and first established apothecaries' shops. In this somewhat subdued light appeared Arabian medicine when looked at from a modern point of view, but in mediæval times, when the great ancient schools were under a cloud, it assumed an importance beyond its merits.

Having given some account of the rise of the Arabian school, it is necessary to retrace our steps, and to enquire into the position of medical science in the western parts of Europe during the second portion of the Transition period, viz.:—from about the seventh to the end of the fourteenth century.

During the rise of medical science amongst the Arabians, the Greek schools declined lower and lower in the scale until they were almost extinct. They were completely dominated by their conquerors. In the western empire, owing to the invasion of the northern hordes of barbarians, anarchy and disorder held sway. In southern Europe matters were not quite so bad. Thanks to the ecclesiastical schools, which, under the sway of the church, carried on literary and scientific studies, some modicum of medical knowledge was retained, medicine fell under the domination of the priests. and they practised as physicians.

In the eleventh century Hughes, abbot of St. Dennis; Didon, abbot of Sens; Sigoul, abbot of Epernay; Archbishop Milo, and others, were well-known physicians. Even religious orders of women undertook the practice of medicine, and Hildegarde, abbess of the convent of Rupertsberg, is stated to have written a work on materia medica. The Jews also about this time practised the healing art. This control of medicine by the clergy, although it did not promote its further development, prevented its extinction. There were no laws or regulations controlling the practice of medicine, and any who desired could enter upon it; so that in addition to the priests, who were not at all highly qualified, there was a multitude of charlatans and rogues of the lowest order.

One bright spot, however, shone forth in this somewhat sombre picture, in the establishment of the school of medicine at Salerno, in southern Italy. The origin of this school is obscure. In the ninth century Salernian physicians were spoken of, and the city was designated Civitus Hippocrita. The number of students and teachers was considerable. It is stated many eminent personages travelled to this seat of learning for treatment, amongst them William the Conqueror. Women were admitted to the ranks of practitioners at this school, and amongst them was the celebrated Trotula, a female professor living in the eleventh century. The reputation of this school was great until the thirteenth century, when the introduction of Arabian

medicine, the rivalry of the university of Naples, and the medical school of Montpellier, were fatal to it. There were many writers associated with the school, of more or less eminence. Amongst them may be mentioned Copho, who wrote the "Anatome Porci," a well known mediæval book; Joannes Platearius, whose "Practica" was several times printed; and Gilles de Corbeil, whose writings on the urine and pulse became medical classics. Nicholas published a work known as "Antidotarium," which was for several centuries the standard pharmacopœia. Roger of Parma, one of the earliest pioneers of surgery, wrote a text-book on this subject, and was first to use the seton as a counter irritant. The best known work, "Regimen Sanitatis Salerni," authorship uncertain, had an immense reputation.

The Salernian practitioners recognised the importance of nausea, vomiting, and bleeding from the ears in head injuries, from a diagnostic point of view. They trepanned for depressed fracture of the skull, and in wounds of arteries ligatures both above and below the opening were applied.

In medicine the general plan of treatment was dietetic rather than by drugs. Anatomy was little regarded.

Although it cannot be said the work of this school advanced the science, it was invaluable in preventing the further decay of medicine and surgery, which was so evident in every other branch of learning. This school formed one of the connecting

links between the ancient medicine of Hippocrates and Galen, and the modern medicine commencing with the rivival of learning.

The school of Montpellier arose in the twelfth century, and was one of the causes of the decline of the school of Salernum.

This school owed its rise largely to Jewish teaching. Many names are mentioned in connection with it, two of them Englishmen. Gilbert of England (1290) wrote the "Compendium Medicinæ," said to contain good observations on leprosy. Still more famous was John Gaddesden, physician-in-ordinary to the king of England, professor of Merton College, Oxford, who wrote "Rosa Anglica" about 1305-15, a treatise characterised by mysticism, lack of common sense and originality. He was the first to formally recommend the "laying on of hands" by the king for the cure of scrofula, whence the ancient term for this disease, "king's evil." Raimond Lulli, religious mystic and alchemist, was connected with this school. He was one of those who sought for the philosopher's stone, wherewith to transmute the baser metals into gold. Besides works on alchemy and theology, he wrote on medical subjects. Although he produced no original work of permanent value, he was a notable figure of his time.

Another famous name is that of Arnold of Villeneuve. To him is due the discovery of spirits of wine and oil of turpentine. He was the first to use brandy in medicine, and regarded it as the

EXTRACTING AN ARROW HEAD (14th CENTURY).
From a MS. in the Library of Trinity College, Cambridge.

SURGEON OPERATING ON THE SKULL (14th CENTURY).
From a MS. in the Library of Trinity College, Cambridge.

elixir of life, hence the name eau-de-vie. In spite of his general honesty, in accordance with the prevailing deceit in medicine, one of his declarations is:—

> "If thou canst not find anything in the examination of the renal secretion, declare that an obstruction of the liver exists. Particularly use the word 'obstruction,' since it is not understood, and it is of great importance that people should not understand what thou sayest."

Other names of this period worthy of mention are those of Gerard of Cremona, who rendered into Latin the works of Hippocrates and Galen; William of Salicet, a famous surgeon; Mondino, a professor at Bologna (1275), who was a great anatomist, and in spite of great opposition dissected the bodies of two women.

Guy de Chauliac was the most famous surgeon in Christendom during the Arabic period. He studied at Montpellier. He opened the abdomen for dropsy, and did not hesitate to operate for hernia and cataract.

The plague, which was very virulent during the fourteenth century, twice appeared in Avignon when he was resident there. He remained at his post, visiting the sick, and himself suffered from this fell disease and was left for dead. "In this frightful position he had sufficient presence of mind to follow the peculiarities of his case, analyse his own sufferings, and to give a description of them worthy of Hippocrates" *(Renouard)*. His

work entitled, "The Inventory," became famous throughout Christendom.

With Guy de Chauliac ends our interest with the Arabic period and the period of transition.

It may be said Montpellier followed in the footsteps of Salerno, in carrying on and sustaining the pursuit of medical science through the dark ages to the brighter era known as the Revival of Learning.

During this period, in spite of its degradation in the hands of uneducated quacks and charlatans, in spite of its superstitious and mystical elements due to the priestly influence, medical science, thanks to the efforts of genuine students and brilliant practitioners amongst the various schools of the period, emerged, if with some of its lustre tarnished, at any rate with its foundation secure. Had it not been for the efforts and devotion to a life-long study of medical science of these few exceptional characters, the evolution of the healing art would have been much slower than it was.

No one can dispute that the men of this transition period, with its turmoil of wars and pestilences, its oppression both political and religious, its mysticism and superstition, ought to take a high place amongst the heroes of science.

CHAPTER III.

Revival of Learning — Thomas Linacre — Brissot — Sylvius—Vesalius—Columbus—Eustachius—Fallopius —Fabricius—Beniveni and Jean Fernel—The Rise of Pathology—Paracelsus—The Renaissance of Surgery —Ambrose Paré — End of Sixteenth Century — The Seventeenth Century—William Harvey—Van Helmont —The Iatro-Chemical School—Le Böe—Willis—The Iatro-Physical School—Borelli—Sydenham.

Various causes are assigned for the intellectual awakening which took place in the fifteenth and sixteenth centuries. The intelligence, hitherto restricted by authority and hide-bound tradition, seemed to be in a state of partial paralysis; but with the advent of the period known as the revival of learning all this seemed to be changed. The human mind, emerging from the dark ages immediately preceding the renaissance, seemed suddenly to be transformed from a condition of torpor and to blossom forth into vigorous action. As stated by Green in his "History of the English People":—

> "The world was passing through changes more momentous than any it had witnessed since the victory of Christianity and the fall of the Roman Empire. Its physical bounds were suddenly enlarged. The discoveries of Copernicus revealed to man the secret of the universe; Portuguese mariners doubled the Cape of Good Hope and harboured their

merchant fleets in the harbours of India; Columbus crossed the untraversed ocean to add a new world to the old; Sebastian Cabot starting from the port of Bristol, threaded his way among the icebergs of Labrador. This sudden contact with new lands, new faiths, new races of men, quickened the slumbering intelligence of Europe into a strange curiosity."

The conquest of Constantinople by the Turks caused an exodus of Greek scholars to the shores of Italy; and Florence, so long the home of freedom and art, became the seat of an intellectual revival.

As a result of this, a taste for Greek literature was acquired in the universities of Italy and was extended to every part of Europe, and resulted in a knowledge of the masterpieces of Greek literature and art.

In addition, the discovery of printing, perhaps as much as anything else, furthered this extraordinary development of learning in all its branches, since by means of printed books the dissemination of knowledge was very greatly promoted.

Owing to these circumstances, reason and intelligence began to triumph over brute force, superstition, and ignorance; and the truths of science, since they were now easily circulated amongst the people, attracted more attention and laid hold of the popular imagination.

Perhaps in anatomy, more than in any other direction, were advances made. By a Papal interdiction in the year 1300, dissection of the human

body was prohibited. It was only towards the close of the fifteenth century this restriction was abolished, and a great impetus was given to the study, and the universities of Italy gave public dissections. This progress in anatomy paved the way for the epoch-making discovery of Harvey in physiology.

In the investigation of medical plants, too, this period was remarkable, and led to the modern science of botany. Intercourse with America and the East led to the introduction of a variety of new plants used medicinally, and resulted in a more rational and complete knowledge of drugs.

The names connected with medical progress during the sixteenth and seventeenth centuries are very numerous. It is only possible to mention the most famous, and to point out in what directions advances were accomplished.

The first name of note is that of Thomas Linacre, of Canterbury (1461-1524). Educated at Oxford, and afterwards at Florence, he became physician to Henry VIII. He translated several books of Galen, and established two chairs, one at Oxford and one at Cambridge, for lectures on the works of Hippocrates and Galen. His great work, however, was the founding of the College of London. In his day, bishops alone had the right to grant permission to practise medicine. Thanks to his influence at Court, Linacre, in spite of great opposition, was able to accomplish his purpose, and secured the issue of letters patent prohibiting the practice of

anyone who had not been examined by the President of the College of London, assisted by three others.

This great achievement earned him the title of "Restorer of Medicine," since by this agency the practice of medicine was taken out of the hands of incompetent monks and ignorant charlatans, and restricted to some extent to the properly qualified.

By his encouragement of the study of the Greek classics, he established in the minds of his contemporaries and his followers the advantage of going to the fountain head of medical lore, instead of relying on the imperfect and dull reproductions of the Arabian school. In this way Greek medicine once more became predominant, and the works of Galen were resorted to rather than those of Avicenna.

As an example of the struggle between the two schools, the controversy in regard to bleeding in acute diseases may be cited. According to the Arabian practice, bleeding was performed by opening a vein in the foot, and letting the blood escape drop by drop. The Greek practice was to let blood from, or near to, the seat of the disease. The latter method was revived by Brissot (1470-1522), a professor in the university of Paris.

In consequence, as it was a revolt against the authority of the Arabian masters, he was expelled from Paris, and his method formally prohibited by parliament. This incident gave rise to a heated controversy, involving several universities, and personages no less important than the Pope and

EXTRACTING LEADEN BULLETS IN THE 16th CENTURY.

From "Opera Omnia Anatomica et Chirurgica," by Andreas Vesalius.

the Emperor, but eventually, it is thought, did much to bring about the downfall of the Arabian school.

Jacques Dubois, or Jacobus Sylvius, as he was sometimes styled, born 1478, was a most successful teacher of anatomy. He was the first to correctly describe all the muscles of the body, and to determine their functions. He discovered the valves of the large veins, and was the first to study the blood-vessels by the aid of coloured injections.

A greater and more independent spirit was manifested in the work of the famous Andreas Vesalius, born 1514 at Brussels. He was educated at Louvain, and afterwards at Paris. So keen was he in the pursuit of his anatomical studies, he used to secure, at much personal risk, the bodies of criminals for dissection. He used to sally forth in the dead of night to Montfaucon, where the execution of criminals took place, and dispute with the dogs for portions of the human body, which he took home for dissection. He also, at great risk, stole bodies from the graveyard.

His daring methods, and close application to the science, soon bore fruit, for at the early age of 29 he published his great work on anatomy, which was far in advance of anything of the sort previously published.

He was the first who had the temerity to contradict the views of Galen, pointing out that the latter relied on the dissection of monkeys, and his descriptions did not accurately represent the human body.

His boldness aroused a great deal of opposition, but, thanks to the spirit of enquiry and scepticism which was a feature of the age, his conclusions, based as they were on the original study of nature rather than showing a slavish subserviency to authority, soon gained him many adherents, who recognised the superiority of his methods. He was a great man, of large, original, and bold mind, and stands out as one of the most prominent figures in medical history.

One of his pupils, Columbus, born 1490, acquired eminence as an anatomist. He came very near discovering the circulation of the blood, since he appreciated the systole and diastole (contraction and expansion) of the heart, and the corresponding dilatation and contraction of the arteries. He also recognised that the pulmonary veins contained arterial blood, and also recognised the fact that the heart was enclosed in a sack or pericardium. In this, his work on the heart and blood vessels, he went much further towards discovering the circulation than any of his predecessors.

Another eminent anatomist of the period was Eustachius, famous amongst other things for his discovery of the passage leading from the throat to the middle ear, and called the Eustachian tube.

Fallopius, born 1523, was another successful and energetic anatomist. His researches covered the whole field of the science, and his name was honoured by being associated with certain important anatomical structures.

Another name that must not be overlooked is that of Fabricius, professor of anatomy at Padua. His greatest claim to fame lay in his embryological discoveries.

In the field of pathology (morbid anatomy) we must note the name of Beniveni (1502). He was the first to point out the value of the examination of the dead body in discovering the cause of disease. This was a most important advance, and his name should be high in the roll of fame.

The name of Jean Fernel also must be associated with that of Beniveni in pathological research. These two famous men may be said to mark the rise of pathology, the study of which is so essential to the correct interpretation of symptoms of disease.

It is thus evident that great strides were made in the study of anatomy and pathology at this time. Permanent theatres were established for lectures and dissections, and chairs of anatomy were created at different universities, the professors being paid out of public funds. Good and accurate anatomical diagrams, by skilful artists, were now published, with correct descriptions of them. The scalpel was used in dissecting for the first time during this period.

A conspicuous figure of the sixteenth century, conspicuous rather for his original personality and views than for his discoveries, is Paracelsus. Authorities differ very much as to the status he ought to occupy in the roll of fame, some asserting he was nothing but a bombastic quack and

charlatan, others that although his views were bizarre and unconventional, there was an element of brilliancy which, by directing men's minds out of the beaten paths, rendered good service in the evolution of medical science. The only gain of any practical use was his introduction of certain mineral remedies. He is also said to have introduced laudanum. He was the chief exponent of the so-called "chemical medicine," and from his time it is always possible to trace a school of chemical practitioners, who though opposed and criticised by the orthodox Galenists, persisted, until, in the seventeenth century, a successor to Paracelsus arose in the celebrated Van Helmont.

Some authorities give Paracelsus credit as a surgical reformer. Whether this is correct or not is uncertain, but without question we find many improvements appearing in the surgery of this time.

During the dark ages, when all sciences retrograded, surgery perhaps more than any other had fallen into evil repute. Medicine, although it suffered in common with other branches of learning, maintained some degree of efficiency, since it remained in the hands of the priests, who were men of some education.

Surgery, on the other hand, owing to the strong prejudice against it, had sunk so low as to become the sport of the most ignorant classes of the community, such as the barbers, bathers, and bone setters. In such poor esteem were these held, it was enacted that no mechanic or artisan might take

an apprentice without a certificate affirming that neither he nor his family had any connection with barbers, bath-keepers, shepherds, or butchers.

It is thus seen that men who were socially ostracised had the monopoly of surgical practice. The reason for this anomalous state of things was the absurd restriction placed by a canon of the church on the priests practising as physicians, which forbade them, under penalty of excommunication, to draw blood. Hence surgery, debarred from the only class with whom it might as a science have maintained a modicum of usefulness, passed into the hands of the lowest stratum of society.

The year 1515, however, marks an epoch in the history of surgery, since the barbers were compelled to study anatomy and surgery, and to pass an examination before being allowed to practise. Thus arose the class of barber-surgeons, and this reform may be said to mark the renaissance of surgery.

Amongst those who helped to revolutionise and reform surgery, Ambrose Paré must take high rank. Born in 1510 of humble parents, he was apprenticed to the barber-surgeons, but, not content with his environment, his ambition led him to Paris, where he studied three years at the Hotel Dieu. His application and skill soon obtained for him the confidence of his teachers, and he appears to have performed operations for them.

During a career full of adventures and incidents, Paré obtained a vast amount of experience. A man of striking personality and magnetism, he seems to

have inspired great faith amongst his contemporaries, and especially amongst his patients.

He was essentially a military surgeon, and especially skilled in the treatment of wounds. His originality showed itself by his breaking away from tradition and old-established custom in the practice of arresting hæmorrhage. Hitherto, all wounds and bleeding stumps were treated with boiling oil. Paré established his fame by daring, although meeting with great opposition, to discontinue this barbarous practice, and adopted the ligature for the spouting artery, and simple dressings instead of the boiling oil and cautery.

By these reforms he saved many lives, and his work deserves strong recognition. As an accoucheur he was distinguished, and restored the forgotten practice of podalic version. Unlike Paracelsus, he wrote plainly, and encouraged publicity concerning his methods of treatment. In this he shines forth as an illustrious figure, exhibiting the highest humanity so characteristic of really great scientists, a state of mind the very antithesis of that shown by charlatans and quacks like Paracelsus.

An indication of the progress made in clinical medicine during the sixteenth century is given by the description of various diseases recognised for the first time. This was largely due to the improved methods of study, brought about by the introduction of clinical instruction in hospitals. Of these diseases the most important were the sweating

sickness (tuberculosis) and syphilis. Whooping cough and malaria we also read of for the first time. Various theories exist as to the origin of syphilis. In all probability the disease had existed from the earliest times, but all its symptoms and clinical features were not recognised until this period.

In the seventeenth century the spirit of scepticism, research and enquiry, which had commenced to show itself so markedly with the advent of the epoch known as the revival of learning, now spread far and wide with remarkable rapidity. Knowledge begets knowledge. Increased acquaintance with one science promotes further insight into the hitherto hidden regions of the companion sciences.

In this century we have abundant evidence of this factor in human progress. On the continent, especially in Germany and Central Europe, where the Thirty Years' War, with its devastations, bloodshed, immorality and pestilences, in the early part of the century, prevented any advancement in learning. But in England, Italy, and the Netherlands, and, to a lesser degree, in France, the progress in human knowledge was decided and material.

In medicine we find the names of Harvey, Van Helmont, Sylvius, Borelli, and Sydenham. In philosophy we have the influence of Descartes, Bacon, Hobbes, and Locke. In science, Kepler, Galileo, and Newton.

With such a wealth of genius was this period

associated, and so completely was its intellectual atmosphere permeated with the spirit of scepticism, there inevitably resulted a great reaction from the idealism of the preceding age. There was a breaking away from the old beaten paths. The inductive method, introduced by Bacon, was an instrument which was still further developed by Hobbes and Locke. Realism was established on a sure basis, and science began to reap a rich harvest.

Zoology and botany were largely extended. The cell doctrine was developed and expounded by Hooker. Malpighi, and Grew. Chemistry showed great advances. In astronomy the work of Copernicus was confirmed and extended by that of Kepler and Galileo. In physics Sir Isaac Newton made his famous discovery of the law of gravitation; Romer calculated the velocity of light—Huygens discovered its polarisation.

When we turn to medicine we find in the discovery of the circulation by Harvey we have to record a piece of original work, which in its importance transcends anything which preceded it.

Historical records of medical lore carry us back to 4000 B.C. It seems almost incredible that the seventeenth century should have been reached before so comparatively simple a phenomenon as the circulation of the blood was accurately observed and described.

The ancients supposed that the veins sprang from the liver and were the only vessels to contain blood,

since the arteries were always found empty after death. In consequence, they imagined the latter only contained air or spirit. The circulation was supposed to pass to and from the liver by undulating wave-like motions in the veins. These views were held until the time of Galen, who disclosed the fact that the arteries contained blood, and that the blood entered the right side of the heart by the great veins. So far he was correct, but he erred in supposing that only a small portion of the blood passed from the right ventricle into the lungs, and that the larger portion filtered through the septum into the left ventricle.

This view of Galen prevailed until the middle of the sixteenth century, when Columbus discovered the lesser circulation through the lungs, but failed to grasp the principles of the greater circulation from the left ventricle through the arteries and veins.

Valves in the veins had been demonstrated, it had been shown that ligature of an artery stopped the flow of blood below it, while if a vein were tied there was shrinking above the ligature and swelling below it. With such data as these to reason upon it could not be long before the final and conclusive inferences were drawn: and to Harvey belongs the honour of putting the finishing touch and establishing, once and for all time, the correct explanation of the circulation of the blood.

William Harvey was born at Folkestone in 1578, and died in 1657. Educated at Cambridge, France,

Germany and Italy, he settled in London and became a member of the College of Medicine. He rose to eminence in his profession, attending James I., and afterwards Charles I. He declined the presidency of the College of Physicians, and after the civil war, retired into private life.

Although soon after 1613 he began to foreshadow his discovery in his lectures, it was not until 1628, when he published his "Anatomical Essay on the Movement of the Heart and Blood," that he made it known to the world.

So conservative is the ordinary individual, any innovation, upsetting as it does his preconceived notions and fossilised doctrines, is apt to excite irritation and arouse protest, rather than evoke applause and honour.

Harvey's essay was no exception, and after its publication he became very unpopular, and he was sometimes heard to say, "he fell mightily in his practice." In referring to the effect produced by his discovery, Renouard says :—

> "So much care and circumspection in search for truth, so much modesty and firmness in its demonstration, so much clearness and method in the development of his ideas, should have prepossessed everyone in favour of the theory of Harvey; but, on the contrary, it caused a a general stupefaction in the medical world, and gave rise to great opposition."

His revolutionary doctrines raised a stirring controversy lasting twenty-five years. Amongst

his supporters were Descartes; John Walæus, the celebrated Professor of Anatomy in the University of Leyden, who confirmed it by new observations; and Plempius, of Louvain, at one time a bitter opponent, publicly acknowledged his conversion to Harvey's views. Harvey lived to see the truth of his discovery universally acknowledged.

This addition to physiology soon led to further discoveries. Malpighi in 1661 discovered the bond of union between the arteries and the veins, viz., the capillary circulation.

In 1687 Cowper saw the blood flowing from the arteries into the veins in the mesentary of a cat, while Stens, professor at Copenhagen, proved the heart to be a muscle which by its contraction expels the blood.

Leuwenhoeck in 1690 was able to demonstrate, by the aid of the improved microscope, the movements of the blood in the small vessels of the larvæ of frogs. These and many other observations of a confirmatory character established Harvey's work on an impregnable basis.

Another effect of this line of research was to produce a more accurate conception of the respiratory process. The theories of the ancient anatomists were hopelessly erroneous. They imagined that the pulmonary tubes anastomosed with the veins, and that in this way atmospheric fluid was conveyed from the lungs to the heart. It was assumed that the air was drawn into the lungs by the heat of the heart, which was the

reservoir of the vital spirit. In its passage through the smaller tubes the air was supposed to become rarified, the purer part passing into the heart, the impure being expired.

All this farago of ill-considered, contradictory and erroneous supposition was in great measure dissipated by Harvey's discovery.

The work of Borelli, Helvetius, and others, directed to a study of the movements of the chest, led to a more or less accurate conception of the mechanism of respiration.

It is thus seen that in physiology, especially, the seventeenth century was productive.

The tendency of this additional knowledge was to prompt men to work, to organise medicine on the basis of the new physiology. The authority of the old dogmatic systems was undermined, and the new movement led to the formation of fresh schools and systems. Of these systems one was the work of an eccentric genius named Van Helmont (1578-1644). A man of birth residing in Brussels, he constructed a system as original and opposed to tradition as that of Paracelsus, and in its day it was highly regarded.

His mind was swayed by philosophical doctrines, and he did not adhere to practical or scientific methods, and, as was only to be expected, a system founded on such an insecure foundation, could not be permanent. Any merits possessed by his teachings lay in his therapeutic measures, which were mild and had some practical merits, and by

adopting newer methods in the preparation of drugs his labours were not altogether barren. It is contended, and with some justice, that he had some share in the formation of the Iatro-chemical school, now to be spoken of.

This school was founded by Le Böe about the middle of the century. It was an attempt to reconstruct medicine on the new knowledge of the circulation, upon the new views of chemistry, and on the unorthodox, fantastic, and unscientific notion of the spirituous or innate heat of the heart. Ostensibly founded on experience, his views rested on the insecure basis of faulty deductions from inaccurate observations. He believed that fermentation which occurred in the stomach played an important rôle in vital processes. Any abnormal disturbance upset the balance of these processes, by causing an excess of acid or alkali, which resulted in diseases.

This cut and dried pathology called forth an equally stereotyped method of treatment. For a time Le Böe had a large following, but later much opposition was aroused, and some critics were cruel enough to state that his system had cost as many lives as the whole Thirty Years' War.

In this country the chief exponent of the system was Willis, and whilst his work was open to the same objections, since it was based on the same faulty principles, some of his views, especially on nervous diseases and on diabetes, are of classical importance. Willis, by applying the advanced

knowledge of chemistry to the examination of the secretions, deserves credit.

Another system, equally famous, the Iatro-physical, was founded by Borelli, of Naples, and was contemporaneous with the Iatro-chemical.

The tendency of this school was to explain the vital processes on physical, especially mechanical, principles. The results obtained belong rather to physiology than to practical medicine. Digestion was supposed to be due to the muscular movements of the stomach; warmth due to friction of the blood corpuscles; the secretions resulted from differences of pressure in various parts of the vascular system. Diseases were explained by the fantastic notion that the blood contained pointed and angular crystals, which irritated as they circulated through the body. Santoro, one of the exponents of this system, first used the clinical thermometer.

Whilst not unprofitable to science, this school was productive of no real advance in practical medicine.

With the name of Sydenham we complete the roll of the eminent pioneers of medicine of the seventeenth century. Educated at Oxford and Montpellier, Sydenham has been styled the English Hippocrates, since he reverted to the Hippocratic methods, relying to a great extent on the close observation of diseases, and the application of remedies at the critical period.

He paid little attention to physiology and anatomy. He regarded diseases as active, the symptoms being

caused by the effort of nature to throw them off; if violent and speedy he recognised the disease as acute; if prolonged, chronic.

Like Hippocrates, he set great stress on closely watching the "natural history of disease," and he also attached great importance to the effect of the weather and other natural causes in modifying disease.

His method of treating fevers was based on common-sense, and characterised by mild measures. He strongly advocated the use of specific medicines, such as mercury in syphilis and Peruvian bark in malaria. A great advocate for bleeding, he often carried it to excess. Without being heterodox he was a slave to no system. A very careful observer, a cautious prescriber, he was essentially practical in his methods. A great clinician, he based his therapeutics on experience.

By ignoring the crude, premature speculations of men like Willis, Borelli, and Van Helmont, he maintained that the reform of practical medicine lay in rejecting theories, relying on close study of natural processes in health and disease.

By concentrating men's minds on facts rather than on theories, he gave an invaluable impetus to the study of practical medicine. Locke, in a letter to Molyneux, sums up the essence of Sydenham's teaching as follows:—

> "You cannot imagine how far a little observation carefully made by a man not tied up to the four humours (Galen), or sal, sulphur, and

> mercury (Paracelsus), or to acid and alkali (Sylvius and Willis), which has of late prevailed, will carry a man in curing of diseases, though very stubborn and dangerous; and that with very little and common things, and almost no medicine at all."

Sydenham thus stands out as one of those rare figures, who, without perhaps any claims to genius, are yet imbued with a great mind, luminous, logical, and abounding in common-sense. His clear reason, surrounded by various attractive and specious systems and theories, was captured by none, but relying on a close study of nature, steered its way clear, through the many shoals and pitfalls surrounding its path.

His was the type of character which makes its mark in history, by its sceptical tendencies, its refusal to conform to authority, and by its dogged adherence to rational methods, based on an accumulation of facts culled from a close study of natural processes.

Our brief survey of the eminent men of this century could have no more fitting ending than its association with the name of Sydenham.

During this century the status of the medical profession, as a whole, much improved. Most of the better-class physicians and surgeons had assumed offices and positions with a salary from the State, or were settled in permanent residences, which was not the case in the previous century.

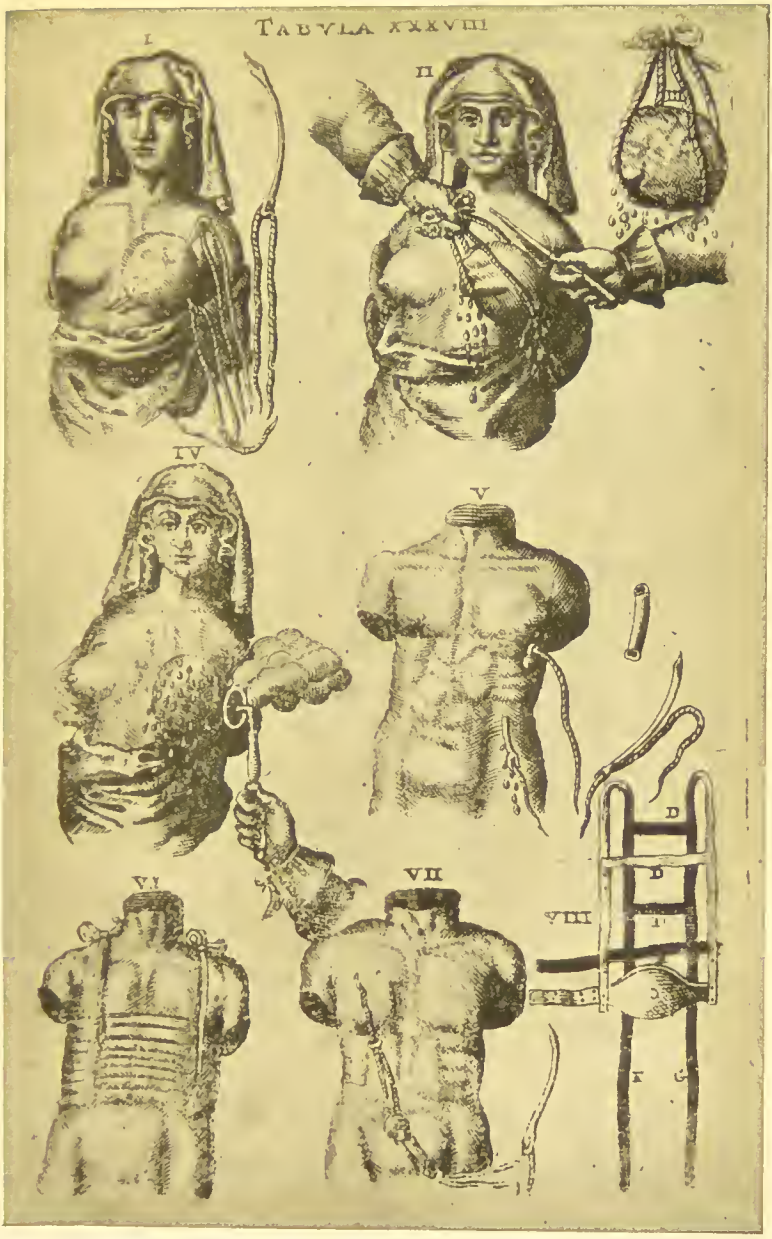
In consequence, the reputation of the entire profession improved, while the unlimited license and freedom of practice prevailing during the Middle Ages was almost entirely done away with. The clerical element, too, had almost entirely disappeared. As has been stated elsewhere, anatomy made great advances. Dissection of the human body was authorised by statute. Previous to this century facilities for anatomical studies were very limited. Vienna did not possess a human skeleton until 1658; Strasburg obtained one in 1671. In Edinburgh an anatomical theatre was erected in 1697 in Surgeon's Hall. It is interesting to note that anatomical plates to be lifted off in layers existed at this time.

To show the ignorance of anatomy existing in the earlier part of this century, it is stated that about the middle of the century there arose a dispute at the bedside of an illustrious patient, the Margrave of Baden, between two learned professors who were attending him, whether a plaster to be applied over his heart should be placed in the middle of the chest, according to Galen, or on the left side. In order to settle the dispute, a hog was opened before the august patient, who was able to satisfy himself with his own eyes that the heart of the hog lay on the left side.

The life of the medical student at this time was characterised by immorality and brutal vulgarity. Student outrages were very common and often

fatal, so much so that the State had to interfere to put a stop to the disgraceful proceedings.

The position assumed by physicians of high class was one of considerable aggrandisement. They wore fur-trained robes, perukes, canes and swords, when prosperous. They were generally esteemed and often sought for, both in public and private.



SURGICAL OPERATIONS ON THE BREAST (17th CENTURY).

From "The Chyrurgeon's Store-House." by Johannes Scultetus.

Plate IV.] [*Medical Science, p. 56*

CHAPTER IV.

THE EIGHTEENTH CENTURY—IATRO-MATHEMATICAL SCHOOL—PITCAIRN AND CHEYNE—MEAD—BOORHAAVE—STAHL—HOFFMANN—HALLER—MORGAGNI—CULLEN—JOHN BROWN—HAHNEMANN—HEBERDEN—MESMER—BRAID—WILLIAM AND JOHN HUNTER—AVENBRUGGER—LÆNNEC—PERCUSSION AND AUSCULTATION—INOCULATION—JENNER AND VACCINATION—STATUS OF THE PROFESSION IN THE EIGHTEENTH CENTURY.

IN the eighteenth century, as in the preceding, considerable advances were made in medical and surgical science. It is difficult to estimate at all accurately the relative importance of one century with another, but it can unquestionably be maintained that from the commencement of the revival of learning each successive century became more important than the one immediately preceding it. The learning of one century, becoming, as it were, the footstool of the next, enabled the seeker after scientific truth to attain to a higher level than his predecessor. In this way the growth of knowledge, as we review it, seems to take place at an increasingly rapid rate.

Bearing this in mind, however, it must not be overlooked that the various disastrous political epochs occurring from time to time must have a retarding influence on the progress of thought. Revolutions, whether against the monarchy or church or any

other social order, distract for the time being the minds of men from the paths of peace and the pursuit of learning, and compel them into the whirlpool of political strife.

But although these epochs have arisen from time to time in the history of the world, their influence is, as a rule, local, affecting only a comparatively limited area; and as a sort of counterpoise, the reactionary influence at work in one country seems to give an added impetus to the progress of another.

In Germany intellectual activity, crippled and retarded as it was in the seventeenth century by the effects of the thirty years' war, burst forth with a superabundance of glory in the eighteenth century. One has only to mention the names of Leibnitz, Kant and Goethe to realise the conspicuous service rendered to all branches of learning by the Germans, and as a practical indication of this intellectual activity, the following universities were started in this century:—Breslau, 1702; Bonn, 1771; Stuttgart, 1781; Pesth, 1794; Gottingen, 1737; Erlangen, 1743.

Whilst the influence of Leibnitz and Kant, with their dualistic conception of the universe, was very great, especially in their own country, the more materialistic views of Locke and Hume affected the intellectual atmosphere around them in England and Scotland.

The eighteenth century, like the end of the seventeenth, is characterised by systems. The Iatrophysical school was still in evidence, but owing to

the effect of Newton's great work in astronomy, it became more mathematical in its character, and is often styled the Iatro-mathematical school. The two principle exponents of this system were Pitcairn and Cheyne, but their doctrines, too dogmatic, and based on unsound data, were of little importance, and added nothing of any permanent value. Mead, an English contemporary, also associated himself with this school, although far from being a whole-hearted supporter of its doctrines, for he showed a decided aversion to too much dogmatic theory. In this he was probably influenced by Locke and Sydenham.

He wrote a mechanical account of poisons, in which he maintained they only acted on the blood. He also published a work on "The Power of the Sun and Moon over Human Bodies." This work shows evidence of Newton's influence, and in it he attempts to show the effects of atmospheric pressure and weather in causing disease.

A name which now appears on the scene is one of far greater importance than any of the preceding. We refer to Hermann Boorhaave (1668-1738), born near Leyden, in Holland. He was one of a family of thirteen. Originally intended for the church, he was an accomplished scholar. Turning his attention to medicine, he studied chemistry, botany, and then anatomy and medicine, qualifying in 1693. After some years of practice in Leyden he eventually, in 1714, became professor of medicine at the university. Like Sydenham, he was essentially a

clinical teacher, and one of rare talent. His clinique gained world-wide fame. The hospital at Leyden, although only consisting of twelve beds, became the most famous school in Europe. Many leading English physicians studied there. Van Sweiten, a pupil of Boorhaave's, adopting his methods, founded the famous Vienna school of medicine. Boorhaave's greatest claim to fame rests on the practical side of his work. He may be said to be the first to construct and organise the study of clinical medicine on modern lines. He was the first to give separate lectures on diseases of the eye, and was the first to use the magnifying glass in examining the eye.

In his teaching and practice he adhered closely to the methods of Hippocrates and Sydenham, relying on close and accurate observation of disease, and adopting an expectant method of treatment, rather than approaching his case with a cut-and-dried theory of its causation, and an equally inelastic method of treatment, such as the rigid adherent of a system would have adopted.

He was essentially an eclectic, choosing what he considered the best points of any system, without being absorbed and biassed by a whole-hearted devotion to it. If he had any preference, it was rather towards the Iatro-mechanical school, but only in a slight degree.

This is borne out by his explanation of digestion, which he considered was based on mechanical principles. He laid great stress on the subject of

inflammation, obstruction, and plethora in his teachings. He also did his utmost to apply all the latest discoveries in anatomy and physiology in the practice of his profession. He used the microscope a great deal, especially in the field of microscopical anatomy.

He, like Sydenham, stands out as a great figure, renowned rather for his methods than for any great addition to knowledge; famous for all time by the purity and simplicity of his life, his strong personality, his whole-hearted devotion to his profession, and his magnificent clinical teaching.

In connection with the early part of this century, two names must be mentioned, interesting from an historical point of view, since they were associated with systems. The importance of their work rests on an academic basis rather than on a practical one.

Stahl (1660-1734), a profound thinker and accomplished chemist, after lecturing in Jena, came to Berlin at the age of 56. Entirely opposed to the methods of Boorhaave, his chief aim was to oppose materialism. Essentially a pietist, his system was permeated by a strong religious element. He regarded his convictions as emanating from a divine source, and was very intolerant of opposition. His doctrine was known as *animism*.

According to his views, the soul governed the organism; it was life-giving and life-preserving, and if interfered with in any way disease resulted. Symptoms of disease originated by the remedial

action of the soul. From this point of view the *soul* corresponded with the *nature* of Sydenham.

He scorned anatomy and physiology, on the application of a knowledge of which, alone, could a correct theory and practice of medicine be established. He was a great chemist, and it must be conceded that in raising chemistry above the level of alchemy, he performed work of great value.

This doctrine of *animism* was a reaction against the chemical and mechanical theories of the seventeenth century. In an age when systems abounded, Stahl's theory of animism gained many followers.

Hoffmann (1660-1742) endeavoured to reconcile the opposing spiritual and materialistic views. His system was based on the supposition of a universal "ether." On this basis are explained all phenomena of health and disease. To pursue his theoretical and fantastic speculations would be unprofitable. His system, based as it was on such insecure foundations, resulted in no permanent advantage.

It is refreshing to turn from the artificial systems of Stahl and Hoffmann, to the more practical work of Haller and Morgagni. The former in the region of physiology, the latter in morbid anatomy or pathology.

The work of these two great men marks an epoch in the history of medicine. Haller, by his researches in physiology, did a great deal to extinguish the system makers whose theories were based on unsubstantial myths. Morgagni, with his post-mortem examinations, greatly extended the know-

ledge of diseased conditions during life. It may be said that modern medicine essentially rests on the combination of the methods of Sydenham and those of Morgagni :—Accurate bedside observation followed by complete post-mortem examinations. Comparison of the symptoms during life with the diseased conditions found after death, leading to a correct interpretation of symptoms and to improved methods of treatment.

Haller (1708-1777) was one of the most versatile scholars of all time, distinguished not only in medicine and allied sciences, but as a poet and statesman. Although his great work was accomplished in connection with physiology, his anatomical researches were far from insignificant.

He increased our knowledge of the structure of the heart, brain and its membranes, taught that the uterus should be regarded as a muscle, and advanced the knowledge of the lymphatic system.

In physiology his achievements were great. Glisson had enunciated the general principles of irritability; Haller proved the existence of irritability in the muscles by experiments, also establishing the fact that irritability is a peculiarity of muscular substance and not governed by ordinary sensation.

He thus originated the doctrine that irritability was a property of muscle, and sensibility the property of nerves, and by this discovery he upset the prevailing systems based on the supposition of a half-concious *anima* directing every action of the body.

Unfortunately his experimental methods were not imitated by his contemporaries, but only led them to expend their energies in constructing other systems more subtle than the last. Eventually, however, the methods of Haller and Morgagni did sweep away these ephemeral systems, and relegated them to the limbo of worn-out and irreconcilable theories.

Morgagni (1682-1772) was the founder of pathological anatomy as a science. His classic work, "De Sedibus et Causis Morborum," marks an epoch in the rational study of diseased conditions.

Few words are required to dismiss the last of the systems resulting from the theoretical tendencies of the eighteenth century.

William Cullen (1712-1790) was professor of medicine at Edinburgh University. His system resembled those of Hoffman and Stahl, inasmuch as his theory was dualistic, since in it he recognised a life-giving element, which he styled nerve force, or nerve principle, or animal force, or brain energy. He drew out a very complicated classification, and his system, founded as it was on metaphysical doctrines, was not of any value. In his treatment he was simple, and discountenanced bleeding, which was much abused in his day.

John Brown (1735-1788) based his system entirely on the doctrine of excitability. The exciting powers, according to his views, either external agents or the functions of the body, caused all vital phenomena, "sense, motion, mental function and passion." In

his view the whole phenomena of life, health as well as disease, resulted from stimulus and nothing else —debility, for example, resulting from deficiency of stimulus.

He divided diseases into sthenic (or acute), and asthenic (subacute or chronic), the former requiring depressing treatment, the latter stimulant. He considered the great majority of diseases required stimulation. On this ground he claimed credit for his reforms, inasmuch as he abandoned the depletory and debilitating methods of his predecessors, and resorted to the opposite plan. His treatment was mild, and he was the first to advocate the modern stimulant or feeding treatment of fevers; using animal soups, such as beef-tea. He is credited with having discerned that certain symptoms, such as convulsions and delirium, were due often to weakness, and did not always result from inflammation, which had hitherto been taught.

It is difficult to understand how these systems seemed to attract and hold such a large following. They resembled a system of metaphysical physiology rather than a rational system of medicine.

Brown's system was supported by Rason in Italy, Weikard in Germany, and Rush in America; in England and France, however, it received little support. In these countries, especially in the former, owing to the strong tendency towards positive science, and the use of the inductive method, a distaste was engendered for theoretical systems. In this feature the influence of Bacon, Locke, and Hume, may be

traced, whereas on the continent, especially in Germany, the abstruse philosophical systems of Leibnitz and Kant encouraged a taste for theoretical speculation.

Another systematiser, whose name must not be omitted is Hahnemann, the originator of homeopathy, whose teachings attract many adherents even to-day. He was as much a revolutionary as Paracelsus. With him symptoms alone were of importance, the study of their causation useless. He ignored the teachings of morbid anatomy gained in the post-mortem room, and enunciated views as to the causation of disease which hardly merits serious attention. In his opinion all chronic diseases result from three ailments, the itch, syphilis and sycosis (a skin disease), or else are caused by medicines. He based his theory of treatment on the dictum, "Similia, similibus, curauter," which he interpreted as based on the law, that in order to cure any disease an agent must be employed similar in character to the disease, but weaker.

He held the extraordinary theory that drugs gained in power by dilution, and if this dilution was accompanied by shaking or pounding, the potency of the drug was still further increased. On this assumption he had his tinctures reduced in strength to 1/50, these again to 1/50, and so on to the thirtieth dilution, which he himself preferred, and used, as possessing the highest efficiency. He thus diluted his drugs to such an extent as to render them impossible of analysis.

In order to discover drugs which produced symptoms like those caused by disease, he experimented on healthy persons with drugs. He did not, however, originate this practice, as it had been carried out previously by Haller. Obsessed as he was by his theory, his results were vitiated by bias.

Owing to the unpopularity of his views amongst his confrères he suffered much opposition, and was compelled to state his case to the lay public, as a court of appeal. This excited much controversy and aroused amongst the public great interest in these scientific questions, and acting as a great advertisement for his eccentric views, no doubt gained Hahnemann many supporters.

He assumed the rôle of martyr to professional jealousy, and appealing to the sense of justice and fair play amongst the public, he achieved great popularity with the masses. His mild methods of treatment, coming as they did when excessive venesection had only been partially replaced by the almost equally drastic methods of Brown's system, soon established themselves in popular favour.

In the first part of his system, viz., the doctrine of "like curing like," Hahnemann was only echoing what had already been formulated by Hippocrates and Paracelsus. His followers might justly claim that the same principle is involved in the modern treatment by vaccines.

His system stands condemned by its absurd pathology, its scorn of anatomy and physiology,

and its extravagant and preposterous theory of dilution.

Heberden, a famous physician (1710-1801) flourishing in this century, must not be overlooked. He was the first to describe chicken-pox and agina pectoris, which was long known as Heberden's asthma.

We now come to the work of Mesmer, the originator of animal magnetism: the forerunner of the modern hypnotism. Although Mesmer was a charlatan and quack, his doctrine rests on a solid foundation. He evidently recognised in some ill-defined and rudimentary way the influence of suggestion on the mind. His methods, crude as they were, and devoid of any solid scientific basis, nevertheless laid the foundation for his successors in this branch of medicine. To-day, hypnotism is recognised and practised as a useful adjunct to therapeutics in certain diseases, and although some writers shower contempt on Mesmer for his unorthodox methods, it must be conceded that he has some claim to fame.

His work was continued by Dr. James Braid, who in 1842 published a work exposing the fallacies of Mesmer's principles, but also dissecting from amongst them the truths they contained.

The names of William and John Hunter are deserving of more than passing reference, since they profoundly influenced the English school of medicine in this country.

The former, a brilliant teacher of anatomy and

successful obstetric physician, was not so well known as his younger brother, John Hunter (1728-1793). Though the name of John Hunter is not connected with any very striking discovery, like that of the circulation of the blood by Harvey, his influence on many sciences was far-reaching and profound.

His work in human and comparative anatomy, in the natural history of plants and animals, in vegetable and animal physiology, and in geology and paleontology, were of such signal value that his labours were productive of progress in each of these sciences.

Hunter, in referring to the light thrown on pathology by the recent physiological discovery of the lymphatics as part of the absorbent system, wrote :—

> "A discovery in any art not only enriches that with which it is immediately connected, but elucidates all those to which it has any relation."

He illustrated the truth of this saying by his own investigations, which, enriching physiology as they did, may be said to have illuminated the whole range of medicine and surgery, and to have given birth to modern pathology, or, as it is termed, the "philosophy of disease."

Hunter also recognised that for a complete scheme of knowledge, deduction and induction are supplementary to each other. He used both methods freely. So memorable were his services,

that in order to commemorate him, there is given annually, an Hunterian oration at the Royal College of Surgeons, London.

Two very valuable diagnostic methods were introduced in this century, Avenbrugger discovering percussion, and Lænnec auscultation.

The former published his great work, the "Inventum Novum" in 1761. His method was that of direct percussion with the tips of the fingers, not that which is now used, of mediate percussion, with the intervention of a finger or plessimeter. This new practice in diagnosing diseases of the chest, especially, was at first received with contempt and ridicule, and did not obtain true recognition until 1808, when Corvisart translated the "Inventum Novum" into French, and the method rapidly acquired a European reputation.

Surpassed as it was, but not eclipsed, by the still more serviceable aid to diagnosis, the art of auscultation, it is not overstating the case to say that this purely mechanical invention has done more for the development of modern medicine than all the "systems" evolved during the eighteenth century.

Lænnec (1781-1826) was the inventor of auscultation, the most important of all the methods of medical diagnosis. Although the discoverer attached undue importance to his discovery, there is no doubt it revolutionised our knowledge of the diseases of the chest. Percussion and auscultation together form the basis of clinical medicine. It must not be forgotten, however, that the examination of diseased

parts after death, and comparing their appearance with the abnormal sounds heard during life, was an essential factor in this reform. Lænnec himself employed the two factors, and had he not been the illustrious inventor of auscultation, he would have been famous for his knowledge of morbid anatomy.

The introduction into Europe of inoculation against small-pox, with its derivative vaccination, belong to this century. In the East the practice reaches far back into antiquity. Mention of it occurs in the Sanskrit Vedas, where it is stated it was practised by the Brahmins, who employed pus obtained from small-pox vesicles the year before.

Their method consisted in rubbing the skin until it was red, then scratching it with a sharp instrument, and laying upon it cotton soaked in the variolus pus moistened by water from the sacred Ganges. They insisted upon careful hygienic measures, and their results appear to have been good. In China, "small-pox was sown" by introducing into the nasal cavities of young children crust from small-pox pustules. The Arabians inoculated with needles, also the Circassians. In North Africa, incisions were made between the fingers, and among some of the negroes the operation was performed upon the nose.

Emanuel Timoni, a physician of Constantinople, described inoculation in 1714. The introduction into this country is described by Lady Mary Wortley Montagu, whose husband was ambassador to the

Sublime Porte. Writing to "Mrs. S. C." from Adrianople, on April 1st, 1717, she says :—

> "Apropos of distempers, I am going to tell you a thing that will make you wish yourself here. The small-pox, so fatal and so general amongst us, is here entirely harmless by the invention of *ingrafting*, which is the term they give it. There is a set of old women who make it their business to perform the operation every autumn, in the month of September, when the great heat is abated. People send to one another to know if any of their family has a mind to have the small-pox; they make parties for this purpose, and when they are met (commonly fifteen or sixteen together), the old woman comes with a nut-shell full of the matter, of the best sort of small-pox, and asks what vein you please to have opened. She immediately rips open that you offer her with a large needle (which gives you no more pain than a common scratch), and puts into the vein as much matter as can lye upon the head of her needle, and after that binds up the little wound with a hollow bit of shell; and in this manner opens four or five veins. The Grecians have commonly the superstition of opening one in the middle of the forehead, one in each arm, and one on the breast, to mark the sign of the cross; but this has a very ill effect, all these wounds leaving little scars, and is not done by those that are not superstitious, who

choose to have them in the legs, or that part of the arm that is concealed. The children or young patients play together all the rest of the day, and are in perfect health to the eighth. Then the fever begins to seize them, and they keep their beds two days, very seldom three. They have very rarely above twenty or thirty in their faces, which never mark; and in eight days' time they are as well as before their illness. Where they are wounded there remain running sores during the distemper, which I don't doubt is a great relief to it. Every year thousands undergo this operation, and the French ambassador says pleasantly, that they take the small-pox here by way of diversion, as they take the waters in other countries. There is no example of any one that has died in it; and you may believe I am well satisfied of the safety of this experiment, since I intend to try it on my dear little son. I am patriot enough to take pains to bring this useful invention into fashion in England; and I should not fail to write to some of our doctors very particularly about it, if I knew any one of them that I thought had virtue enough to destroy such a considerable branch of their revenue for the good of mankind. But that distemper is too beneficial to them not to expose to all their resentment the hardy wight that should undertake to put an end to it. Perhaps, if I live to return, I may, however, have courage to war

with them. Upon this occasion admire the heroism in the heart of your friend, etc."

Her infant daughter was inoculated in England in 1721. There was a great deal of opposition, some doctors calling it "an artificial way of depopulating a country." Inoculation slowly gained ground. In 1746 a hospital for inoculation of the poor was built in London. The Prince of Wales and his sister were inoculated, and the practice became popular. One forgotten poet wrote an ode on the subject, commencing with the invocation, "Inoculation, heavenly maid." Improvements in method made the practice less dangerous. It is stated that Daniel Sutton and his assistant are said to have inoculated 20,000 cases without a single death that could "fairly" be attributed to the operation.

This statement must be received with considerable reserve. Other writers indicate the mortality at about 2%, whereas the mortality from small-pox was 20%. Considering that a very large percentage of adults had small-pox in that day, it must be admitted that the practice was not only justifiable, but decidedly advantageous, and it is not to be wondered at that it maintained its popularity until superseded by the superior claims of vaccination. It was abolished in 1840 by Act of Parliament.

The first inoculation with cow-pox seems to have been performed in 1774, by a farmer of Gloucester, named Jasty, though the chief exponent of the practice, and the one to put it on a sound

scientific basis, was Edward Jenner, of Berkeley, in Gloucestershire, generally known as the "father of vaccination." Brought up in the country, and serving his apprenticeship with a country practitioner, he made observations of the protective power of "cow-pox" against small-pox, firmly established as this belief was by popular observation. So struck was he by the possibility of allaying the scourge of small-pox, which was terrible in those days, the subject became with him an obsession. It is stated that nearly every adult, man and woman, had small-pox in his time, so that it may readily be understood the prospect of being able to alleviate this scourge would strongly appeal to any humane man.

In 1770, Jenner became a pupil of John Hunter, who, when told of the idea, exclaimed, "Do not think, investigate." Jenner accordingly went to Berkeley, and there, by experiment and observation, established the reputaton of vaccination. In 1798 he published his memorable work. He died full of fame and honour, and since his time the practice has gradually spread, and maintained its hold on popular favour in spite of strenuous opposition from a few extremists.

Inoculation and vaccination against small-pox represent the earliest attempts at serum treatment, by rendering a person immune by introduction of an attenuated virus. Ignorance of bacteriology, however, prevented the further development of this line of treatment.

The principle involved in the process was not really understood, and the line of treatment was essentially empirical.

Amongst other reforms witnessed in this century, improvement in the treatment of the insane was most marked. Until the end of the century these unfortunates were treated with great brutality. Fettered, confined in cages, uncleanly, ill-clad and ill-fed, they were treated rather as degraded criminals than as sufferers from disease. Towards the end of this century, however, special institutions were established for their care, and humane methods of treatment began to be adopted. Moreover, schools for instruction in mental diseases were started, and the true nature of their ailments began to be recognised.

In this century, too, thanks to the researches of Hahn, hydro-therapeutics became popular; and Currie, in England, in 1797, used cold sponging and cold packs in reducing fever.

Medicine as a profession in the eighteenth century may be said to have reached its zenith. It was regarded more from the ethical standpoint and less from the utilitarian, worldly or business point of view. Physicians were fewer and their social position was high; those possessed of the degree of doctor ranking among the gentry. Professors were often attached to the courts of their sovereigns. The income of the average practitioner would be from £200 to £300 per annum, equivalent to three times that amount to-day. Relatively,

therefore, the profession was much better paid than at the present time.

The regulation full dress of the English physician of the period consisted of a well-powdered wig, silk coat, knee breeches with stockings, buckled shoes, lace ruffles, cap and gold-headed cane, also in cold weather was added a muff to preserve the delicacy of touch. Upon graduation a cap was placed upon the head, in recognition of the fact that at an earlier period physicians belonged to the clerical profession. To-day at the graduation ceremony at Edinburgh University, the cap worn by John Knox is used, to shed some reflected glory on the head of the young graduate.

CHAPTER V.

THE NINETEENTH CENTURY—ITS PHILOSOPHY—THE EFFECT ON MEDICAL AND ALLIED SCIENCES—ANÆSTHETICS—WELLS — MORTON — LONG — JACKSON — SIMPSON — ANTISEPTICS — APPERT—GUY LUSSAC — SCHWANN — PASTEUR — TYNDALL — LISTER.

WHEN we consider the last hundred years in the history of medical science, we are impressed with the fact that this period, although comparatively limited in time, is almost unlimited in material progress. It is safe to say that more progress was made in the nineteenth century than during the whole of the preceding ages since the earliest historic times.

The tendency of the philosophy of the century was essentially materialistic in character. Comte's positive philosophy was an attempt to prove that a careful study of the laws of the universe and human nature would reveal the fundamental laws of progress, and that these truths properly systematised would form a philosophy and a religion. His most important follower was Claude Bernard, the great physiologist, and upon the work of these two the whole exact school of France is based.

But above all, in philosophy, this century will always remain immortal for the conception and elaboration of the doctrine of evolution. Associated

with this great scheme, are the names of Charles Darwin, Wallace, Herbert Spencer, Hæckel, Huxley, Tyndall, Clifford, Romanes, and Weissmann. This theory is founded on natural science; its data accumulated by painstaking and accurate observation of natural phenomena, and its conclusions arrived at by logical reasoning. Its growth has extended over a long period of years; by its merits it has been judged and has found almost universal acceptance.

On the one hand it has been assailed by the scathing invectives of the Church, on the other hand it has had to contend against the uncompromising and often bitter criticisms of scientists themselves. It has emerged from this searching ordeal, shorn of some of its trappings perhaps, but with its fundamental principles intact. The doctrine of evolution may be termed the philosophy of the age, and is reflected in all departments of thought, and as we have seen before, medical science is particularly susceptible to the influence of the prevailing philosophical views.

The close study of nature in all directions, which gave rise to this philosophy, extended itself to all science, and in medicine the tendency became more and more firmly established to search amongst natural phenomena for the genesis of disease. This principle of searching for the cause of disease led to the true principles of rational treatment, viz., given a disease, remove its cause. Perhaps in pathology, with its derivative bacteriology, have the

greatest strides been made, but physiology, too, has been greatly influenced, and undoubtedly most material progress has resulted from the painstaking study of the causation of diseases coupled with increased accuracy in diagnosis and treatment.

Amongst allied sciences the increased study of botany influenced progress not a little. The researches into plant cells by Schleiden, Hooker, and Baumgartner, paved the way for the discovery of animal cells by Schwann and for the more recent cellular pathology. The great exponent of the cellular pathology was Virchow. He showed all bodies are built up of cells, and each cell has a unity and purpose of its own. This doctrine is sometimes known as "modern vitalism." For the old vital force of the preceding century, which was supposed to be either distributed throughout the entire body in an indefinite manner, or in a few organs, he substituted the idea of the vital force distributed throughout the entire body, in each individual cell. This idea has been elaborated by Hæckel in his theory of the "cell soul." The principle is expressed lucidly and succinctly by Virchow himself, and I cannot do better than quote his words:—

> "Every animal principle has a sum of vital unities, each of which bears all the characteristics of life. The characteristics and unity of life cannot be found in any determinate point of a higher organism—for example, in the brain—but only in the definite, ever-recurring arrangement of each element present; hence it results

that the composition of a large body amounts to a kind of social arrangement, in which each one of the movements of individual existence is dependent upon the others, but in such a way that each element has a special activity of its own, and that each, although it receives the impulse to its own activity from other parts, still itself performs its own functions."

Under the influence of this pathology, the old "humoral pathology" was abandoned, since the blood is now regarded rather as a medium by which noxious materials are conveyed from one part of the body to another, than the seat of disease itself.

Researches in zoology, with which is incorporated comparative anatomy, have had great influence in throwing light on many problems, both anatomical and physiological. Improved chemistry has greatly extended the pharmacopœia, and also added a great deal of positive knowledge to physiological processes occurring in the body, such as the process of digestion in all its ramifications, and also thrown much light on the functions of the excretory organs.

Again, the development of physics has introduced the use of the ophthalmoscope and medical electricity. Another feature of the century has been the enormous increase of scientific associations, and the numerous additions to medical and scientific literature.

It is thus evident that the key-note of the century is the domination of science, the scientific method,

the scientific spirit. An age of rationalism, scepticism, and enquiry as opposed to dogma.

In other departments of science we have witnessed the advent of the steam engine, and its evolutionary product, the petrol engine—electricity applied in the telegraph, the telephone, and the marconi system of wireless telegraphy.

The advances in medical science are equally astonishing. The earliest part of the century was still tainted by the love of systems exhibited in the preceding. None of them, however, merit any serious attention. The century is replete with the names of famous men. Trousseau, specially noted for his studies of croup, and employment of tracheotomy, and his splendid clinicial teaching. Sir Charles Bell, for his work on spinal nerves, by which he established the fact that the posterior roots preside over sensation, the anterior over motion. Marshall Hall, for his discovery of reflex action.

In Dublin we have the famous trio of physicians, Cheyne, Stokes, and Graves. Whilst in surgery there may be mentioned the names of Billroth, in Germany; Duputren, in Paris. In England, we have Astley Cooper and Brodie; in Scotland, Syme and Lister. All these famous men flourished in the early Victorian period, and one and all added his quota to the sum of human knowledge.

In the later part of the century, so numerous are the names of noted physicians and surgeons, it would be invidious to single out any for special praise. We must confine ourselves especially to those

associated with the special epoch-making discoveries of the century, and we will commence with the introduction of anæsthetics and antiseptics, the discovery of which revolutionised surgery.

Although there are glimpses here and there, in ancient literature, of attempts to deaden sensibility before operation, no agent was discovered, which was effectual as well as safe, until the middle of the nineteenth century. There is good reason for believing the mesmeric sleep was used by the ancients, although the method was not used scientifically until after the days of Mesmer. In 1776 Mesmer arrived in Paris, and after that date produced a state of anæsthesia in a number of patients, and operated without pain.

The ancients certainly used narcotic drugs to stupefy patients about to undergo painful operations; opium, henbane, Indian hemp, mandragora, have all been referred to in ancient literature, and known from earliest times. In the Bible alcohol seems to be the most common narcotic. Socrates drank hemlock during the last hour of his life, so as to soothe his passage to the grave. Mandragora was in great demand. Apuleius, writing a century later than Pliny, says:—

> "If any one is to have a member mutilated, burned, or sawed, let him drink half an ounce of mandragora with wine, and let him sleep till the member is cut away, without any pain or sensation."

In more recent times many surgeons used to

operate upon patients who were narcotised with alcohol. Until the introduction of nitrous oxide gas, ether, and chloroform, however, no reliable or efficient anæsthetic was discovered.

To America belongs the honour of first having discovered and put to practical use the virtues of ether and nitrous oxide gas. The use of the latter preceded that of ether by a year or two. To Horace Wells belongs the honour of having first used nitrous oxide gas. He was a dentist at Hartford, Connecticut. He appears to have been of a very ingenious mind, quick to seize on and apply any innovation. In 1844, after hearing a lecture by a Dr. Colton on the gas, he noticed that a young man who had inhaled some, became excited and ran against some furniture without feeling any pain. Wells was so struck with this incident, that the next day he inhaled the gas himself and had a tooth extracted painlessly. It is stated that on coming round he exclaimed:—"A new era in tooth pulling. It did not hurt me as much as the prick of a pin. It is the greatest discovery ever made."

To whom is due the honour of having first used ether as an anæsthetic is a disputed point. There are no less than four claimants for the honour: Long of Danielsville, Jackson of Plymouth, Mass., both physicians; and Wells of Hartford (the discoverer of nitrous oxide gas), and Morton of Charlestown, Mass., both dentists. Long graduated in 1839 at the university of Pennsylvania. It appears to have been a sort of pastime amongst the students to

inhale ether. Long frequently inhaled the drug and noticed its anæsthetic properties. It is stated, so impressed was he by this property of the drug, that he determined to try it in surgery, and in 1842 he removed a small tumour from the neck of a patient, without pain, under its influence.

He lived 130 miles from a railway; medical literature in those days was limited in extent, and only indifferently circulated. No record appears to have been made of Long's work until 1849, when he first published an account of his operations. It seems probable, however, that he was the first to use the drug as an anæsthetic.

Wells appears to have partially grasped the value of ether only to relinquish it and to return to the use of nitrous oxide.

Morton was born in 1819, and came under the influence of Wells in 1841, to whom he acted as assistant. Afterwards he left Wells and associated himself with Jackson. Jackson suggested to Morton the use of ether instead of nitrous oxide, and on the evening of September 30th, 1846, Morton extracted a tooth under the anæsthetic influence of ether. From that time onwards ether has been used universally in general surgery. Jackson also claimed to have used ether as far back as 1837. A violent quarrel between the four seems to have occurred. A memorial sent to the United States parliament by several hundred members of the Massachusetts Medical Society, gives the following verdict on this controversial question :—

> "The undersigned hereby testify to your honourable bodies that, in their opinion, William T. G. Morton first proved to the world that ether would produce insensibility to the pain of surgical operations, and that it could be used with safety. In their opinion, his fellow men owe a debt to him for this knowledge."

Morton died at a comparatively early age, worn out by disappointment, and, as he thought, persecution. Jackson became insane and died in an asylum. Sir James Paget justly apportions the merit to the four claimants as follows :—

> "While Long waited, and Wells turned back, and Jackson was thinking, and those to whom they had talked were neither acting nor thinking, Morton, the practical man, went to work and worked resolutely. He gave ether successfully in severe surgical operations, he loudly proclaimed his deeds, and he compelled mankind to hear him."

Chloroform was first introduced as an anæsthetic agent by Simpson, of Edinburgh. Simpson used ether extensively in his practice, both as a surgeon and as an obstetrician, with great success. He quickly perceived the shortcomings of ether, however, and set himself to discover some substance possessing the advantages, without the disadvantages, of ether.

With the same courage that had inspired Morton, Simpson, with his colleagues, Dr. George Keith, and Dr. Mathews Duncan, sat down night after

night to inhale substance after substance. These experiments continued through the summer of 1847, and it was not until November, 1847, that the intrepid investigators first tried the effects of chloroform. Professor Miller, Simpson's colleague, thus describes the sèance at which chloroform was first tried :—

> "Late one evening, it was the 4th of November, 1847, in returning home after a weary day's labour, Dr. Simpson with his two friends and assistants, Drs. Keith and Duncan, sat down to their somewhat hazardous work in Dr. Simpson's dining-room. Having inhaled several substances, but without much effect, it occurred to Dr. Simpson to try a ponderous material which he had formerly set aside on a lumber table, and which on account of its great weight he had hitherto regarded as of no likelihood whatever; that happened to be a small bottle of chloroform. It was searched for and recovered from beneath a heap of waste paper. And with each tumbler newly charged, the inhalers resumed their vocation. Immediately, an unwonted hilarity seized the party, they became bright-eyed, very happy, and very loquacious, expatiating on the delicious aroma of the new fluid. The conversation was of unusual intelligence, and quite charmed the listeners, some ladies of the family and a naval officer, brother-in-law of Dr. Simpson. But suddenly there was a talk of sounds being

heard like those of a cotton mill, louder and louder; a moment more and then all was quiet—and then crash! On awakening, Dr. Simpson's first perception was mental—'This is far stronger and better than ether,' said he to himself. His second was to note that he was prostrate on the floor, and that among the friends about him there was both confusion and alarm. Hearing a noise he turned round and saw Dr. Duncan beneath a chair, his jaw dropped, his eyes staring, his head bent half under him, quite unconcious, and snoring in a most determined and alarming manner. More noise still and much motion; and then his eyes overtook Dr. Keith's feet and legs making valorous attempts to overturn the supper table, or more probably to annihilate everything that was on it. By-and-bye, Dr. Simpson having regained his seat, Dr. Duncan having finished his uncomfortable and unrefreshing slumber, and Dr. Keith having come to an arrangement with the table and its contents, the sedurent was resumed. Each expressed himself delighted with this new agent, and its inhalation was repeated many times that night—one of the ladies gallantly taking her place and turn at the table—until the supply of chloroform was exhausted."

From this time onward Simpson used chloroform extensively, and its use has been universal ever since. In a little more than a year, therefore,

since the discovery of the anæsthetic properties of ether by Morton, Simpson had crowned the achievement by the discovery of the equally wonderful and beneficial powers of chloroform.

He met with violent opposition from the Scottish clergy, who abused him for endeavouring to relieve the pains of child-birth, on the grounds of the text, "In sorrow shalt thou bring forth children."

Simpson retaliated and completely routed the worthy divines by fighting them with their own weapons. Quoting from Genesis ii. 21, where it is written :—"And the Lord God caused a deep sleep to fall upon Adam and he slept; and He took one of his ribs and closed up the flesh instead thereof."

They had attacked him as a man of science, and, like Huxley at a later date, Simpson proved his knowledge of scripture fully equalled their own. He read them a true lesson, pointing out that if God had willed pain to continue to exist, no possible device of man could have ever relieved it. Simpson also met with great oppositon from his own profession. But by argument and statistics he eventually gained a complete victory over his opponents, and the fight for anæsthesia was won. He died in 1870, and upon his bust in Westminster Abbey is this inscription :—

> "To whose genius and benevolence the world owes blessings derived from the use of chloroform for the relief of suffering."

No mention of anæsthetics would be complete without referring to the local anæsthetic, cocaine.

Karl Koller demonstrated to the Congress of German oculists, at Heidelberg in 1884, its uses in operations about the eye. Its use rapidly spread to other branches of surgery, and to-day it is used universally in minor surgery. Recently an extension has been made in the use of local anæsthetics by injection into the spinal cord; the effect being to produce anæsthesia in all regions supplied by the nerves coming from the cord below the point of injection. This method is becoming more popular, and is of value especially in cases where a general anæsthetic is contra-indicated.

When one attempts to realise the horrors of surgery before the advent of anæsthetics, one cannot help appreciating the incalculable boon to humanity their introduction has been. When Simpson first saw an operation without anæsthesia, so horrified was he that he contemplated abandoning his studies, and even went so far as to enter upon legal work instead. As stated by H. Laing Gordon, in his life of Simpson, when depicting the terrible sufferings of surgery in the earlier part of the nineteenth century:—

> "The operating theatre then has been compared to a butcher's shambles; cleanliness was not considered necessary, and little attention was paid to the feelings of the patient. He was held down by three or four pairs of powerful arms as the surgeon boldly and rapidly did his work, despite the screams, stopping, perhaps, only to roughly abuse the patient for some

agonised movement which had interfered with the course of action. The poor wretch saw the instruments handed one by one by the assistant, and heard the surgeon's calm directions, and his remarks on the case. The barbarous practice of arresting the bleeding by the application of red-hot irons to the surface of the wound had indeed ceased three centuries before, when that humane reformer, Paré, displaced it with the method of tying the open blood-vessel, but the patient's blood gushed forth before him until arrested, into the saw-dust spread to receive it, and the sight and the hot odour of it oftentimes mercifully caused him to faint."

This horrible picture brings forcibly home to one the blessings of chloroform. The surgeons of those days vied with one another in the rapidity of their operations. Their success largely depended on the time taken over the operation, the amount of shock and loss of blood being proportionate to its duration. Surgeons became of necessity callous to suffering, their nerves became of iron, and their whole exterior impressed with their terrible environment. Tennyson doubtless remembered those days when he wrote:—

"Sent a chill to my heart when I saw him come in at the door,
Fresh from the surgery schools of France, and of other lands:
Harsh red hair, big voice, big chest, big red merciless hands."

It will thus easily be appreciated that the rise of anæsthetics marks an epoch of the first importance

in the history of medical and surgical science. In its practical effects in relieving human suffering, in extending the use of surgery, and in its soothing application in obstetrics, it must rank as one of the most important discovéries ever made in the world's history.

Following on this great reform, we have now to record another, the importance of which it is impossible to over-estimate. We refer to the advent of Antiseptics. The discovery of antisepsis is indissolubly connected with the names of Pasteur and Lister. Before this reform in surgery was accomplished, the mortality in hospitals, both military and civil, was frightful. The same may be said in connection with maternity hospitals, the mortality in these cases being as high as 12·24% in some hospitals, due to uncleanliness and the dreadful habit of allowing students to pass from the dissecting room to the lying-in wards without taking any precautions to disinfect their hands.

Amongst those who, in the early part of the century, laid the foundation on which the principle of antisepsis was built up, must be mentioned Appert, a French confectioner, who discovered a method of preserving meat, fruit and vegetables by excluding the air and hermetically sealing the vessel in which they were contained. Guy Lussac examined the air contained in Appert's bottles, and finding it devoid of oxygen, jumped to the conclusion that the presence of oxygen caused putrefaction.

In 1837 Schwann, experimenting on putrefaction, proved the error of Guy Lussac's deduction. He placed decoctions of meat in flasks, sterilised them by boiling, and then supplied them with calcined air, the power of which to support life he showed to be unimpaired. Under these conditions putrefaction never set in. This was an important step in advance, since he concluded rightly that putrefaction was not due to the contact of air alone, as stated by Guy Lussac, but to something suspended in the air. Schwann's investigations were corroborated by Helmholtz in 1843.

The next researches were those of Schroeder and Dusch in 1854, who proved that filtration of air prevented the fermentation of boiled fluids to which such filtered air had access. Pasteur's remarkable series of experiments finally and definitely established the view that putrefaction was due to the organism suspended in the air and not to the gases of the air itself.

He conducted his experiments with the double object in view—the first in order to refute the doctrine of spontaneous generation, and secondly to establish the fact that all fermentation is due to the presence of minute organisms, and without these fermentation could not exist. In 1862 Tyndall confirmed Pasteur's conclusions, and demonstrated the truth of his inferences by experiments extending over several years. Writing to Pasteur, he says:—

> "For the first time in the history of science we are justified in cherishing confidently the hope

> that, so far as epidemic diseases are concerned, medicine will soon be delivered from empiricism and placed on a real scientific basis. When that great day shall come, humanity will, in my opinion, recognise the fact that the greatest part of its gratitude is due to you."

It was on April 30th, 1878, that Pasteur gave the famous lecture in which he propounded the germ theory. In this exposition of the theories he had elaborated occurred the following pregnant sentence :—

> "If I had the honour of being a surgeon, convinced as I am of the dangers caused by the germs of microbes scattered on the surface of every object, particularly in the hospitals, not only would I use absolutely clean instruments, but after cleansing my hands with the greatest care and putting them through a flame (an easy thing to do with a little practice), I would only make use of charpie, bandages and sponges which had previously been raised to a heat of from 130° C. to 150° C., and I would only employ water which had been heated from 110° C. to 120° C."

This work of Pasteur and others into the causes of fermentation, and the further researches of Pasteur, Davaine and Koch into the agency of micro-organisms in producing disease in animals, laid the foundation of the science of bacteriology, and demonstrated the fact that the real cause of

BACTERIA.

1. Tubercle Bacilli in Expectoration.
2. Tetanus Bacilli (Lockjaw), *from a Culture.*
3. Micrococci in Pus from Abscess.
4. Cholera Bacilli in Blood.
5. Spirilla in Blood.
6. Bubonic Plague Bacilli.

[*Medical Science, p.* 94.

Plate V.]

infectious and contagious diseases is the putrefactive changes set up in the tissues and fluids of the living body by the many known bacteria. This immense and illuminating field of research may be said to form the basis of modern medicine, and to open up a rich field for future investigation, the far-reaching effects of which we are only beginning to realise.

To Lister, the surgeon, belongs the credit of applying practically the discoveries of Pasteur, Tyndall and Koch; which had established the germ nature of infectious diseases, medical and surgical, and the germicidal effect of filtration, of heat, and of certain substances.

Joseph Lister was born in 1827 at Upton, in Essex. He graduated in medicine in 1852. Shortly after qualifying he visited Edinburgh and acted as assistant to Syme. In 1860 he was appointed Professor of Surgery to Glasgow University.

His early research work was confined rather to the domain of Physiology and Pathology. In the former his work was represented by papers on the contractile tissue of the iris, the muscular tissue of the skin, the minute structure of involuntary muscular fibre, the flow of the lacteal fluid in the mesentery of the mouse, and the influence of the nervous system in regulating the contractions of the arteries. In pathology his attention was particularly devoted to the phenomenon of inflammation. By these early researches he gave abundant

evidence of possessing, in a high degree, resourcefulness in experiment, conscientious accuracy in the observation of facts, and a broad and logical mind.

At the time of his appointment at Glasgow, surgical diseases were scarcely ever absent from the wards of the hospitals. Tetanus, eryisepelas, septicæmia, pyæmia, and hospital gangrene, were universally prevalent, knowledge of their causation was not forthcoming, and there was no rational line of treatment for them.

Sir Hector Cameron, who worked under Lister when he made his first attempts in the direction of antisepsis, draws a graphic picture of the surgical horrors then existing.

> "Every wound discharged pus freely, and putrefactive changes occurred in the discharges of all, producing in the atmosphere of every ward, no matter how well ventilated, a fetid, sickening odour, which tried the student on his first introduction to surgical work, just as much as the unaccustomed sights of the operating theatre. It is hardly necessary to add that fatal wound diseases and complications were never absent at any time from the hospitals of that day."

Writing of hospital gangrene in 1801, John Bell says:—

> "When it rages in a great hospital it is like a plague; few who are seized with it can escape. There is no hospital, however small, airy, or well regulated, where this epidemic ulcer is not

to be found at times; and then no operation dare be performed! Every cure stands still! every wound becomes a sore, and every sore is apt to run into gangrene, but in great hospitals especially it prevails at all times, and is a real gangrene. It has been named the Hospital Gangrene, and such were its ravages in the Hotel Dieu of Paris (that great storehouse of corruption and disease) that the surgeons did not dare to call it by its true name; they called it the rottenness, foulness, sloughing of the sore! The word, hospital gangrene, they durst not pronounce; for it sounded like a death bell; at the hearing of that ominous word the patients gave themselves up for lost. In the Hotel Dieu this gangrene raged without intermission for two hundred years, till of late, under the new government of France, the hospital has been reformed. 'A young surgeon,' says an ancient French author, 'who is bred in the Hotel Dieu, may learn the various forms of incisions, operations too, and the manner of dressing wounds, but the way of curing wounds he cannot learn. Every patient he takes in hand, do what he will, must die of gangrene.'"

These scourges so impressed Lister as to produce a feeling of horror and discontent, and inspired him with a determination to bring about a reformation. According to Sir Hector Cameron:—

"Lister soon began to enjoin on all persons in his clinic the practice of scrupulous cleanliness,

which was at that time by no means always a characteristic of surgical practice. The washing of hands was insisted on after dressing each individual case, and large piles of clean towels stood on the tables of his wards for the use of his dressers and nurses."

He also used deoderant lotions, and recommended frequent changing of dressings in all suppurating wounds. Progressive and admirable as these changes were, they were not sufficient to entirely transform surgical results. It was not until Lister concentrated his mind on the discoveries of Pasteur, which revealed the causes of putrefactive fermentation to be the development of living organisms in the dust of the atmosphere, that he entered upon the final stages of his work, which resulted in such a triumphant success.

He first used carbolic acid, and selected compound fractures as suitable for its application. At that time, these cases were the dread of surgeons, and usually resulted in amputation. The effect of Lister's treatment was immediate and striking, repair occurring at once, without any disturbance of the general system. Amputation in these cases became almost a thing of the past, and not only innumerable limbs, but innumerable lives also, were saved. From compound fractures he extended his methods to abscesses and other wounds, with equally striking results.

Lister first made his treatment known to Pasteur by the following letter of February 13th, 1874:—

"My Dear Sir,

Allow me to beg your acceptance of a pamphlet which I send by the same post, containing an account of some investigations into the subject which you have done so much to elucidate, the germ theory of fermentative changes. I flatter myself that you may read with some interest what I have written on the organism which you were first to describe, in your 'Memoire sur la Fermentation Appelée Lactique.'

I do not know whether the records of British surgery ever meet your eye. If so, you will have seen from time to time notices of the antiseptic system of treatment which I have been labouring for the last nine years to bring to perfection.

Allow me to take this opportunity to tender you my most cordial thanks, for having, by your brilliant researches, demonstrated to me the truth of the germ theory of putrefaction, and thus furnished me with the principle upon which alone the antiseptic system can be carried out. Should you, at any time, visit Edinburgh, it would, I believe, give you sincere gratification to see at our hospital how largely mankind is being benefited by your labours.

I need hardly add that it would afford me the highest gratification to show you how greatly surgery is indebted to you.

Forgive the freedom with which a common love of science inspires me, and

Believe me, with profound respect,

Yours very sincerely,

JOSEPH LISTER."

The essence of Listerism is not the mere treatment of wounds with antiseptics, it is the adoption of the principle of the exclusion from the wound of all agencies which have the power of causing putrefaction. He pointed out the importance of scrupulous care in technique, the absolute asepsis of the operator, his assistants, his instruments, and the necessity of using aseptic catgut and dressings. In short, he inculcated an all-round thoroughness of method, based on the true principle of the causation of septic processes. By eliminating the cause of putrefaction, he accomplished a revolution in surgical results.

The whole of Lister's life has been devoted to improving his methods. There has never been any hesitation in discarding an old friend if any defect was discovered. As an instance of this, the carbolic spray, at first *de rigeur*, was promptly abandoned when found inefficient. He laboured constantly and persistently in improving ligatures and dressings, constantly striving after simplification of the latter without impairing their efficiency.

The more extended application of Lister's methods was attended with abundant and ever-increasing success. Operations were performed with success which before could only have resulted in disaster. Lister's system cannot be said to have depended on any single brilliant discovery, but has developed slowly and surely, step by step, only after careful study and experiment. Like all innovations, his

doctrines were at first received with scepticism and distrust.

Simpson and others regarded the germ theory as a dream, and referred to the germs contemptuously as "mythical fungi." Others compared them to revival of the belief in aerial sylphs and spirits.

Lucas Championniere once stated there were only two periods in surgery—that before Lister and that since Lister—and it must be admitted that the line of demarcation is very pronounced.

Fifty years ago, it was stated by a famous surgeon in Germany that 80% of all wounds were attacked by hospital gangrene, and erysipelas after an operation was almost considered normal. To-day, it is stated 98% of all wounds in hospital heal by first intention.

Not only has the effect been to lower mortality, but also to greatly increase the scope of surgery. Five-and-twenty years ago the late Sir John Erichsen stated that operative surgery had reached its acme. There were, he said, three regions into which the knife of the surgeon could never penetrate, viz., the brain, the chest and the abdomen. These regions have long ago been conquered, and this we owe to Lister. Another feature resulting from his work is the comparative painlessness of wounds. When the late Professor Huxley visited the Edinburgh Royal Infirmary, he summed up his impressions as follows:—

> "What amazes me, Mr. Lister, is the painlessness of your wounds. You have not only banished those awful scourges which used to

affect our wards, but you have abolished the pain and suffering associated with wounds and surgery."

The life and work of Lord Lister, as here only imperfectly sketched, abundantly indicate, not only the merits of his intellectual achievements, but also of his character.

A life of patient toil, self-sacrificing devotion to duty, and absolute honesty of purpose, has attained its reward, not only by the honours and dignities which have been conferred upon him, but still more by the knowledge that his labours have very largely reduced mortality, and mitigated suffering, and have thus proved an incalculable benefit to humanity at large.

The debt owing to these two great men, Pasteur and Lister, for their immortal work, is one that can never be repaid.

CHAPTER VI.

Bacteriology—Vaccine Therapy and Serum Treatment — Rontgen Rays — Finsen Light — High Frequency Current — Radium — Treatment by Baths — Public Health Measures—Metchnikoff's Theory—Sour Milk —Animal Extracts—Conclusion.

The history of the science of bacteriology may be said to commence with the observations of Antony Leuwenhoeck, of Delft. In 1675 he manufactured a microscope of sufficient power to exhibit very minute organisms occurring in water or putrefying fluids.

These organisms had never been observed before, and were at that time quite unknown. It was not until a century later that Müller, a Danish investigator, in 1775 made further researches on the same lines, and described some three hundred organisms occurring in water.

No further advance was made until 1830, when Ehrenburg, with improved instruments, described bacteria more elaborately. Ignorance of culture methods, however, prevented him from accurately and completely discovering their true nature. A few years later, Cohn showed that bacteria were plant cells, since they corresponded with these in growth and structure. The further researches of Schwann, Henle, Schrœder and Dusch all aided in

forwarding bacteriological research, and led up to the work of Pasteur, to which reference has already been made.

The work of Pasteur, Tyndall, Koch, Lister, and others, in their researches into the causes of putrefaction or sepsis, still further developed the science, and laid the foundations of the most modern department of therapeutics, viz., treatment by serums or vaccines.

Vaccination against small-pox, discovered by Jenner, was undoubtedly the first example of vaccine treatment. The bacilli in small-pox and cow-pox have been described by Dr. Copeman as being similar morphologically, and the presumption is that vaccine from the cow owes its action to the presence in it of what was once the small-pox bacillus, but which has become attenuated in such a way as to render it capable of conferring immunity against small-pox, equal to that conferred on any individual by an attack of the disease itself. It is on this principle of attenuation, or weakening of the virus, that the modern vaccine therapy is founded. The vaccine of cow-pox, used by Jenner, was attenuated by nature; modern vaccines are attenuated or weakened by artificial means.

The essential feature of vaccine therapy is that it excites in the patient his own inherent protective mechanisms, and endeavours to evoke or to increase them sufficiently to offer a successful resistance against the infective bacterial agent and its local or general effects. The artificially prepared vaccine

consists of bacteria devitalised by heat, or modified by some other agency or condition, or it may be composed of extracts derived from the bacterial protoplasm by various means.

The injection of the vaccine leads to the development, locally, of anti-bacterial substances, or opsonins, as they are termed, in quantities more than sufficient to neutralise the bacteria or bacterial substances introduced, leaving a surplus which can be carried by the blood and lymph to other parts, to augment the resistance offered to the original infection.

Some examples of vaccines are Pasteur's preparation for the treatment of hydrophobia, Koch's tuberculin for consumption, and more recently Wright's vaccine for pneumonia and typhoid fever. This treatment has also been used for acne, boils, and carbuncles.

The most recent advance in the vaccine treatment is the estimation of the correct dose required in individual cases, by taking what is called the *opsonic index*. This is obtained by counting the number of bacteria ingested or destroyed by a certain number of the white cells in the blood of the patient when mixed with some serum of the patient's blood, and comparing this count with that obtained when the lencocytes or white cells of the patient are mixed with serum taken from a normal individual. The serum contains the opsonins, and in this way the relative amount of opsonins possessed by an individual for any particular bacterium can be measured.

Serums such as are used in diphtheria, puerperal fever, erysipelas, etc., act on rather different lines. They are prepared by inoculating a horse with increasing doses of the infective micro-organisms until immunity is complete, and then using the serum of the horse as a remedy. These serums, or antitoxins, act as it were by introducing an antidote into the system of the patient. They introduce the antitoxins produced in the serum of the horse, and the effect is to artificially induce in the patient a destruction of the morbid bacteria.

Pasteur introduced his hydrophobic treatment in the year 1886. Previous to this, no remedy was known which was of the slightest avail, and the mortality was great, but since that date the mortality has been under one per cent. From the beginning of 1886 to the end of 1895, over seventeen thousand persons were inoculated, that is about seventeen hundred per year.

Pasteur discovered, by experimenting on dogs and rabbits, that inoculation with a fresh spinal cord taken from a hydrophobic animal always produced typical rabies, but when a cord that had been dried for some days was used this did not happen. He showed that by inoculating with a cord that had been dried for fourteen days, and then following up with one that had been dried for a shorter period, he could produce protection against rabies. He found the same process might be used as a remedial measure in cases of persons already bitten, but success is to some extent governed by the length of

time allowed to clapse between the infection and the commencement of treatment. The sooner the treatment commenced the better the chance of recovery. The treatment was thoroughly examined and favourably reported on by an English commission.

The antitoxin treatment of diphtheria was discovered by Behring and Kitisato in 1890. Their discovery of the existence of the antitoxic properties of the serum of the blood of animals rendered immune to diphtheria, and their application of this remedy, laid the foundation of the serum treatment, which is unquestionably one of the most important advances of the century.

The value of this treatment in diphtheria is now fully recognised. The results obtained bear out the prophecy of the discoverers, that the mortality of this deadly disease would be reduced to five per cent.

In the same year Koch's introduction of tuberculin in the treatment of tuberculous complaints raised great hopes that a remedy for this devastating sickness had been discovered.

The value of tuberculin in diagnosis has been established without question. Its curative value, whilst discounted by some, is warmly advocated by others. Dr. Philip, physician and lecturer on clinical medicine at Edinburgh University, writing in the *British Medical Journal*, July 31st, 1909, says:

> "The discovery of tuberculin in 1890 meant an entirely new conception of treatment in

tuberculosis. At first tuberculin attained but a precarious foothold in medical practice. On the reasons for this I shall not enter. During the years which have elapsed it has been continuously used by me as a therapeutic agent. There has been ample time for experiment, observation, and reflection. These have been not less satisfactory because of the reserve and even distrust with which the agent was commonly treated. Necessarily mistakes occurred, and conceptions and methods have shifted from time to time. Looking back, it is gratifying to have the opportunity to state that throughout the period there has grown and remained with me the conviction, which is ever ripening, that in tuberculin we have a remedy of first importance in the treatment of tuberculosis. The cases treated have been very numerous, and of varying kinds and types. The net result is a decisive verdict in favour of tuberculin."

Fresh serums and vaccines are being introduced every year. The tendency seems to be to enlarge the scope of the vaccine treatment, regulating the dose by the opsonic index. There is a widespread belief in the profession that vaccine therapy is of great value, and likely to have (when the methods connected with it are perfected) a revolutionary effect on the treatment of disease.

The discovery of the Rontgen Rays by Professor Rontgen in 1895 added another valuable diagnostic and curative agent. These rays penetrate the soft

tissues, but fail to penetrate bone or certain metallic substances. This peculiar property has been used for photographic purposes with remarkable results.

The diagnostic value of these rays is becoming more and more apparent every year. Their therapeutic use is more open to discussion. Their application as a remedial agent has been most extensive, they having been tried, at one time or another, for practically every disease, in some instances with great benefit.

In diagnosing fractures and dislocations they are of the utmost value. They can be used with a florescent screen, in which the picture is shown instantly, or a photograph may be taken as a permanent record. Most dislocations can be seen on a screen, and their reduction is rendered easier. Where the parts are very dense, as at the hip joint, or in a case of stone on the kidney, a photograph is best. Inflammatory swellings and new growths can be seen on the bones, and a good deal of useful information may be obtained in this way. Spinal malformations, and other bony abnormalities, foreign bodies, collections of pus, can all be diagnosed by the rays. In certain diseases of the heart and lungs useful information can sometimes be obtained. Nearly all oxalate of lime and phosphatic calculi, and many of the uric acid calculi, may be seen. Gall stones also can sometimes be detected.

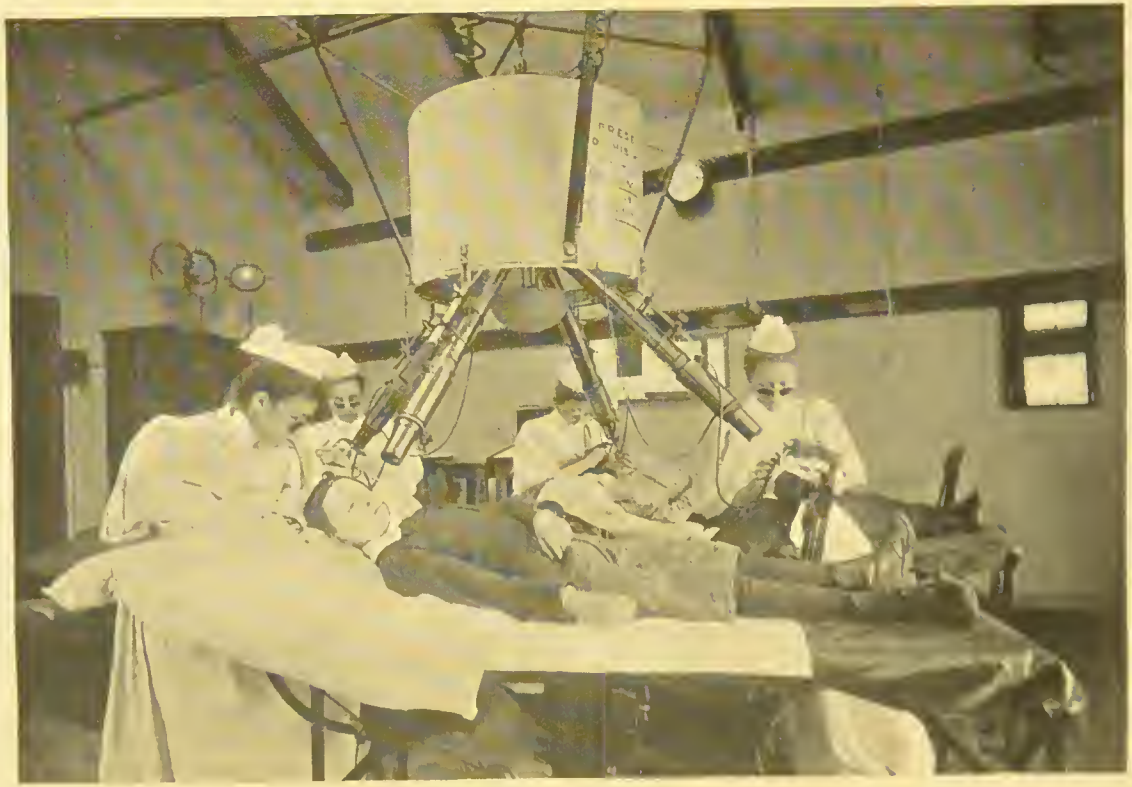
As a curative agent, the main use of the rays has been in the domain of skin diseases. Rodent

ulcers, at one time considered incurable, respond readily to this treatment. They quickly scab over, the scab drops off, and the ulcer heals. Lupus vulgaris, a tuberculous disease of the skin, is especially suited to this treatment. More applications are required than in rodent ulcer, and in some cases do not respond well. Ringworm, it is generally acknowledged, is most effectively treated. Also it is claimed that superficial cancer of the epitheliomatous type has been cured by this agency, and many cases have been ameliorated.

Under this head, viz., the treatment of malignant growths, it must be noted that X-rays are of various kinds, some acting on the superficial tissues, some immediately below the skin, and some penetrating through the whole mass of a part of the body. By filtration of the rays, it is hoped to be able to concentrate the treatment on deep-seated growths, and produce a result as satisfactory as in the case of the more superficial tumours.

Other conditions treated are certain cases of skin disease, such as eczema and psoriasis, and unusual growths of hair, as on the upper lip or chin of women.

The whole subject, however, is still sub judice; improved technique and increased experience will probably produce improved results. It may confidently be predicted that there is a great future for the development of the X-rays. At present it may be said that where surgical interference is possible (as in cancer cases), or where ordinary medical



THE FINSEN LIGHT IN USE AT LONDON HOSPITAL.
(Queen Alexandra's Lamp.)

Plate VI.] [*Medical Science, p.* 111

means are applicable and usually effective, these should be used, and the X-ray treatment should be kept in reserve.

On the other hand, in diagnosis this discovery is of the utmost value, and is day by day scoring fresh triumphs, both in medicine and surgery.

The Finsen Light treatment is similar in character to the treatment by X-rays. A particular lamp is used. The electric arc is struck between two iron electrodes, which are hollowed out so as to permit of a circulation of water in them for cooling purposes. The lamp is rich in violet and ultra-violet rays. The treatment has proved of value in cases of skin disease where X-rays have failed.

Treatment by the high frequency current has been much in vogue of late years. Although at first much was hoped of this line of treatment, latterly results have been somewhat disappointing.

The discovery of radium by Professor and Madame Curie has added another curative agent to the list. So long as this substance, however, is so scarce and so expensive, its use must be much restricted. The results obtained from using small quantities afford evidence of the value of radium, and give rise to the belief that were larger quantities available, its application would be very greatly extended. Its value in rodent ulcer and small carcinomata has been amply demonstrated. Dr. Dominici, of Paris, claims to have successfully treated tumours of malignant character by inserting small glass tubes containing radium into the growth.

At present it is too early to speak at all emphatically of the scope of this agent. That it is a powerful one is amply proved.

Considerable advance must be noted in treatment by baths. The Schott treatment for heart disease, consisting of immersion in effervescing baths, has proved valuable in certain cases.

Hot air baths for chronic rheumatic and gouty conditions have effected an advance in the treatment of these painful diseases. By rendering the air quite free from moisture, very high temperatures can be reached without any burning or scalding effect.

The administration of "Public Health" has of late years made great strides, and is continuing to occupy much attention. Such measures as the compulsory notification of infectious diseases, inspection of school children, inspection of dairy premises and slaughter houses, inspection of drainage and sewage disposal, inspection of cottage property and prevention of overcrowding, and the regulation of a proper water supply, are all being strictly enforced. The inclusion of tuberculosis as a notifiable disease amongst pauper patients is a step in the right direction, but it is to be hoped its application will be extended to all cases; only by notification and isolation of consumptives can we hope to stamp out this scourge. The open-air treatment so much in vogue, conducted in open-air sanatoria, is doing much to mitigate the evils of

this disease. The establishment of state-aided institutions of this sort is an imperative need for the health of the community, expense, amongst the poor, where isolation of these cases is specially needed, prohibiting the advantages of isolation and open-air treatment.

The organisation of the public health service throughout the country is being much improved, and great service is being rendered in a quiet, unobtrusive way by applying the principles of preventive medicine.

In one direction, however, has a retrograde step been taken. Under the latest regulations of the Local Government Board, evasion of that very essential prophylactic measure, vaccination, has become quite simple, and we are rapidly becoming an unvaccinated community. The inevitable penalty is sure to follow, and when it is too late we shall wake up to the dangers of the situation. Vaccination is compulsory in most civilised countries, and the advantages of the practice have been conclusively proved.

In addition to these public health measures, research institutions have been established. Good work is being done in cancer research, and it is hoped and believed good will eventually be derived therefrom. At present, however, it cannot be said that the true nature of this disease has been discovered, nor has any cure been evolved. The cure of cancer and consumption,

the two great scourges of the human race, will, we trust, immortalise the twentieth century, just as the discovery of anæsthetics and antiseptics shed a lustre over the preceding century.

Much attention has been attracted of late to the theory of Professor Metchnikoff, of the Pasteur Institute, in connection with the lactic acid bacillus, and the consumption of sour milk.

Metchnikoff observed that in Bulgaria and Roumania, the use of sour milk, curdled by means of a living culture of the lactic acid bacillus, is very extensive. He also noticed the unusually large proportion of healthy old people to be seen in these parts. Bulgaria, with a population of about 3,000,000, has more than 3,000 centenarians, many of these exceeding the century by five, ten, or even twenty years.

After careful investigation, Metchnikoff satisfied himself there was a direct connection between this diet of sour milk so largely adopted, and the noticeable longevity of the people. He found by experiment this bacillus has a retarding effect on the putrefactive processes following the ingestion of food. Even with a healthy digestion, there is some faulty metabolism, usually the result of over-eating, giving rise to the formation of a certain amount of decomposition of the food, and the absorption of poisons into the system. If the digestion is faulty this process is exaggerated, and results in indigestion, constipation, and other troubles.

Anything which will retard this process obviously will confer a benefit on mankind in many ways. Professor Metchnikoff claims that the sour milk bacilli have this effect, because they eat up the disease-producing germs. He maintains, and it may be conceded, without exaggeration, that the sour milk diet not only tends to prolong life, but also tends to render it more agreeable while it lasts. The remedy to be applied to the best advantage must be accompanied by a spare diet. Like most innovations, this "cure" has been overdone. In some unsuitable cases it has done harm. Used with discretion this discovery is undoubtedly beneficial.

The introduction of animal extracts as curative agents is another product of the latter part of the nineteenth century. The use of bone marrow in anæmia, thyroid gland in goitre and certain skin diseases, adrenolin (extract of the supra renal capsules) as a hæmostatic, to mention some of the principle, gives some indication of their use. In many cases undoubted benefit results from their remedial action.

It will thus be seen that the middle and latter portion of the nineteenth century has been rich in the production of new discoveries in medicine and surgery. No other period, in any degree, approaches this one in its brilliancy. The triumphs of science in other directions have been equalled if not outrivalled in the sciences of the healing art.

If those who succeed us in this the twentieth

century, progress at the same rate, it is difficult to put a limit to their possible attainments.

When we attempt to enter the hazardous field of prophecy, and ask ourselves along what lines is the advance most likely to be made, we enter the region of speculation pure and simple; and yet there are certain tendencies in modern methods which seem to indicate, in a more or less definite way, the probable lines of development.

In preventive medicine we undoubtedly have an agency which must have in the future, as it has had in the past, great influence in modifying and stamping out disease. When we come to remedial measures, we may safely say that the advances will be on more than one line.

The close study of pathology, including bacteriology, will establish many important facts in the causation of disease. Further study in bacteriology will undoubtedly reveal much that is now hidden.

That vaccine and serum therapy has a great future is certain. Although in its infancy, the results in many instances are most satisfactory, and in some cases almost startling. Based as it is on sound scientific principles, the probability is that rapid improvements in the preparation of vaccines and serums, and in regulating the dosage, will be forthcoming; and a proportionate gain in the value of the treatment.

Another field where there is scope for great advances is in mental derangements. Here,

pathology will probably unfold much that is now obscure, and treatment of the insane will be much more successful than hitherto.

Surgery, too, will continue to claim its triumphs, but it is difficult to realise how this, the more mechanical side of the profession, can show any very great and material progress. So much is now accomplished, it is difficult to conceive where any great improvements can arise.

Looking ahead, say fifty or one hundred years, we seem to see a time when many diseases now existing will be stamped out.

The old drugs, so sacred to the old-time practitioner, will be discarded, one by one, until none are left, and those diseases which still persist will be treated by animal extracts, vaccines or serums, X-rays or radium. Tuberculosis will be stamped out, and cancer research will eventually reveal the hidden mystery underlying this scourge. Improved and abstemious methods of diet, coupled with Metchnikoff's sour milk, will prolong life, and hygiene and physical culture will aid in maintaining a robust stock.

The outlook from a health point of view should certainly be a sanguine one. When we look back over the long vista of years, from the dawn of medicine to the present time, we cannot fail to be impressed with the immense progress accomplished; and when we look to the time to come we are equally impressed by the strong conviction that there is a golden future in store, in which there will

inevitably be a very great alleviation of human suffering and misery.

> "All this world is heavy with the promise of greater things, and a day will come, one day in the unending succession of days, when beings, beings who are now latent in our thoughts and hidden in our loins, will stand upon this earth, as one stands upon a footstool, and laugh, and reach out their hands amidst the stars."—WELLS, *The Discovery of the Future.*

Spells? Mistrust them!
- Mind is the spell which governs earth and heaven
Man has a mind with which to plan his safety
Know that and help thyself.
- Empedocles.
(By Matthew Arnold)

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